ORGANIC ELECTROLUMINESENT ELEMENT

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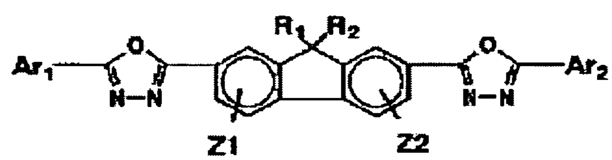
Abstract of **JP11185960**

PROBLEM TO BE SOLVED: To provide a organic electroluminesent element which excels in light emitting efficiency and emits light with high luminance by nipping and holding at least one layer containing at least one kind of compound having a specific structure between a pair of electrodes. SOLUTION: At least one layer containing at least one kinds of compound expressed by the formula (where, each of Ar1 and Ar2 denotes a substituted or unsubstituted aryl group, R1 and R2 each denotes a hydrogen atom, straight- chain, branched or ringlike alkyl group, substituted or unsubstituted aryl group or substituted or unsubstituted aralkyl group, and each of Z1 and Z2 denotes a hydrogen atom, a halogen atom, straight-chain, branched or ringlike alkyl group, straight-chain, branched or ringlike alkoxyl group or substituted or unsubstituted aryl group) is nipped and held between a pair of electrodes. In this case, the layer containing the compound expressed by the equation is a light emitting layer and an electron injection transfer layer and contains a light emitting organic metal complex.



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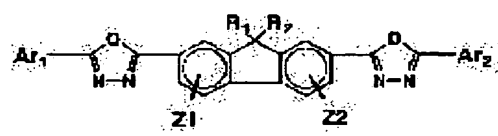
(54) ORGANIC ELECTROLUMINESENT ELEMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a organic electroluminesent element which excels in light emitting efficiency and emits light with high luminance by nipping and holding at least one layer containing at least one kind of compound having a specific structure between a pair of electrodes.
SOLUTION: At least one layer containing at least one kinds of compound expressed by the formula (where, each of Ar1 and Ar2 denotes a substituted or unsubstituted aryl group, R1 and R2 each denotes a hydrogen atom, straight- chain, branched or ringlike alkyl group, substituted or unsubstituted aryl group or substituted or unsubstituted aralkyl group, and each of Z1 and Z2 denotes a hydrogen atom, a halogen atom, straight-chain, branched or ringlike alkyl group, straight-chain, branched or ringlike alkoxyl group or substituted or unsubstituted aryl group) is nipped and held between a pair of electrodes. In this case, the layer containing the compound expressed by the equation is a light emitting layer and an electron injection transfer layer and contains a light emitting organic metal complex.



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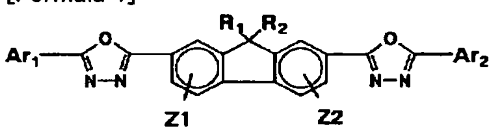
CLAIMS

[Claim(s)]
[Claim 1] Organic electroluminescence devices which come at least to pinch the layer containing at least one sort of compounds expressed with a general formula (1) and (** 1) to inter-electrode [of a pair] further.
[Formula 1]



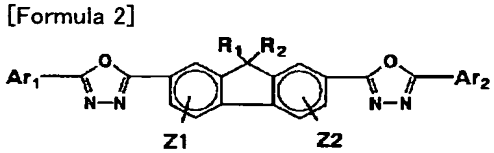
(1)

(Among a formula, Ar1 and Ar2 express the aryl group which is not permuted [a permutation or], R1 and R2 express the aralkyl radical which is not permuted [the aryl group which is not permuted / a hydrogen atom, a straight chain branching or an annular alkyl group, a permutation, or / a permutation, or], and Z1 and Z2 express the aryl group which is not permuted [a hydrogen atom, a halogen atom, a straight chain, branching or an annular alkyl group, a straight chain, branching, an annular alkoxy group, a permutation, or])
[Claim 2] Organic electroluminescence devices according to claim 1 whose layer containing the compound expressed with a general formula (1) is a luminous layer.
[Claim 3] Organic electroluminescence devices according to claim 1 whose layer containing the compound expressed with a general formula (1) is an electron injection transportation layer.
[Claim 4] Organic electroluminescence devices according to claim 1 to 3 to which the layer containing the compound expressed with a general formula (1) is further characterized by containing a luminescent organometallic complex.
[Claim 5] Organic electroluminescence devices according to claim 1 to 4 which have a hole-injection transportation layer further in inter-electrode [of a pair].
[Claim 6] Organic electroluminescence devices according to claim 1 to 5 which have an electron injection transportation layer further in inter-electrode [of a pair].

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to organic electroluminescence devices.
[0002]
[Description of the Prior Art] Conventionally, although inorganic electroluminescence devices have been used as the panel mold light sources, such as a back light, in order to make this light emitting device drive, the high voltage of an alternating current is required for them. Recently came and the organic electroluminescence devices (an organic electroluminescent element: organic EL device) which used the organic material for luminescent material were developed [Appl.Phys.Lett., 51, and 913 (1987)]. Organic electroluminescence devices are components which emit light using the light which has the structure pinched between an anode plate and cathode in the thin film containing a fluorescence organic compound, injects an electron and an electron hole (hole) into this thin film, and is emitted in case an exciton (exciton) is made to generate and this exciton deactivates by making it recombine. organic electroluminescence devices — severalV- dozens -- it is the low battery of about V direct current, and luminescence of various colors (for example, red, blue, green) is possible by being able to emit light and choosing the class of fluorescence organic compound. As for the organic electroluminescence devices which have such a description, the application to various light emitting devices, a display device, etc. is expected. However, generally, luminescence brightness is low and is not enough practically.
[0003] As an approach of raising luminescence brightness, the organic electroluminescence devices which used for example, tris (8-quinolate) aluminum as a luminous layer, and used the host compound, the coumarin derivative, and the pyran derivative as a guest compound (dopant) are proposed [J.Appl.Phys., 65, and 3610 (1989)]. Moreover, organic electroluminescence devices were using for example, screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum as a luminous layer, and using the host compound and the acridone derivative (for example, N-methyl-2-methoxy acridone) as a guest compound are proposed (JP,8-67873,A). moreover, a luminous layer -- OKISA diazole derivative, 1 [for example,], and 3-screw [5'-(p-N and N-dimethylamino phenyl)- 1, 3, and 4-OKISA diazole-2' -- [Jpn.J.Appl.Phys.31, 1812] as which the organic electroluminescence devices using - IRU] benzene are proposed (1992). However, these light emitting devices are also hard to be referred to as having sufficient luminescence brightness.
[0004] moreover, an electron injection transportation layer -- 2'-(4''-phenyl phenyl)-5'-(p-tert-buthylphenyl)- [Appl.Phys.Lett., 55, and 1489] as which the organic electroluminescence devices using 1, 3, and 4-OKISA diazole are proposed (1989). However, the preservation stability of this light emitting device is very bad, and hard to be called practical component. In current, organic electroluminescence devices by which preservation stability was improved and which emit light in high brightness further are desired.
[0005]
[Problem(s) to be Solved by the Invention] The technical problem of this invention is offering the organic electroluminescence devices which are excellent in luminous efficiency and emit light in high brightness.
[0006]
[Means for Solving the Problem] this invention person etc. came to complete this invention, as a result of examining organic electroluminescence devices wholeheartedly. That is, this invention is the organic electroluminescence devices which come at least to pinch the layer containing at least one sort of compounds expressed with a general formula (1) and (** 2) to inter-electrode [of ** pair] further, and [0007].
[Formula 2]



(1)

(Among a formula, Ar1 and Ar2 express the aryl group which is not permuted [a permutation or], R1 and R2 express the aralkyl radical which is not permuted [the aryl group which is not permuted / a hydrogen atom, a straight chain branching or an annular alkyl group, a permutation, or / a permutation, or], and Z1 and Z2 express the aryl group which is not permuted [a hydrogen atom, a halogen atom, a straight chain, branching or an annular alkyl group, a straight chain, branching, an annular alkoxy group, a permutation, or])
** The organic electroluminescence devices given [aforementioned] in ** the given layer containing the compound

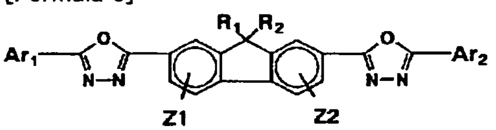
expressed with a general formula (1) is a luminous layer, ** The organic electroluminescence devices given [aforementioned] in ** the given layer containing the compound expressed with a general formula (1) is an electron injection transportation layer, ** Organic electroluminescence devices given in either the aforementioned ** to which the layer containing the compound expressed with a general formula (1) is further characterized by containing a luminescent organometallic complex - **, ** It is further related with inter-electrode [of organic electroluminescence devices given in either the aforementioned ** which has a hole-injection transportation layer - **, and ** pair] at organic electroluminescence devices given in either the aforementioned ** which has an electron injection transportation layer - ** inter-electrode [of a pair].

[0008]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail. The organic electroluminescence devices of this invention come at least to pinch the layer containing at least one sort of compounds expressed with a general formula (1) and (** 3) to inter-electrode [of a pair] further.

[0009]

[Formula 3]



(1)

(Among a formula, Ar1 and Ar2 express the aryl group which is not permuted [a permutation or], R1 and R2 express the aralkyl radical which is not permuted [the aryl group which is not permuted / a hydrogen atom, a straight chain branching or an annular alkyl group, a permutation, or / a permutation, or], and Z1 and Z2 express the aryl group which is not permuted [a hydrogen atom, a halogen atom, a straight chain, branching or an annular alkyl group, a straight chain, branching, an annular alkoxy group, a permutation, or])

[0010] It sets to the compound expressed with a general formula (1), and is Ar1. And Ar2 The aryl group which is not permuted [a permutation or] is expressed. In addition, an aryl group expresses heterocycle type aromatic series radicals, such as ring type aromatic series radicals, for example, a furil radical, such as a phenyl group, a naphthyl group, and an anthryl radical, a thienyl group, and a pyridyl radical.

[0011] Ar1 And Ar2 desirable — un-permuting — or As a substituent, for example, a halogen atom, an alkyl group, an alkoxy group, They are a ring type aromatic series radical with a single permutation or 6-20 total carbon which may be many permuted, or a heterocycle type aromatic series radical with 3-20 total carbon in an aryl group. Or more preferably Un-permuting or a halogen atom, the alkyl group of carbon numbers 1-14, the alkoxy group of carbon numbers 1-14, It is a ring type aromatic series radical with a single permutation or 6-20 total carbon which may be many permuted in the aryl group of carbon numbers 6-10. Or still more preferably It is a ring type aromatic series radical with a single permutation or 6-16 total carbon which may be many permuted in un-permuting or a halogen atom, the alkyl group of carbon numbers 1-4, the alkoxy group of carbon numbers 1-4, or the aryl group of carbon numbers 6-10.

[0012] Ar1 And Ar2 As an example, for example A phenyl group, 1-naphthyl group, 2-naphthyl group, 2-anthryl radical, 9-anthryl radical, 2-fluorenyl group, 4-quinolyl radical, 4-pyridyl radical, 3-pyridyl radical, 2-pyridyl radical, 3-furil radical, 2-furil radical, 3-thienyl group, 2-thienyl group, 2-oxazolyl radical, 2-thiazolyl radical, 2-benzoxazolyl radical, 2-benzothiazolyl radical, 2-benzoimidazolyl radical, 4-methylphenyl radical, 3-methylphenyl radical, 2-methylphenyl radical, 4-ethyl phenyl group, 3-ethyl phenyl group, 2-ethyl phenyl group, a 4-n-propyl phenyl group, 4-isopropyl phenyl group, 2-isopropyl phenyl group, a 4-n-buthylphenyl radical, 4-isobutyl phenyl group, A 4-sec-buthylphenyl radical, a 2-sec-buthylphenyl radical, A 4-tert-buthylphenyl radical, a 3-tert-buthylphenyl radical, A 2-tert-buthylphenyl radical, a 4-n-pentyl phenyl group, 4-isopentyl phenyl group, A 2-neopentyl phenyl group, a 4-tert-pentyl phenyl group, A 4-n-hexyl phenyl group, 4-(2'-ethyl butyl) phenyl group, A 4-n-heptyl phenyl group, a 4-n-octyl phenyl group, 4-(2'-ethylhexyl) phenyl group, A 4-tert-octyl phenyl group, a 4-n-DESHIRU phenyl group, a 4-n-dodecyl phenyl group, A 4-n-tetradecyl phenyl group, 4-cyclopentyl phenyl group, 4-cyclohexyl phenyl group, 4-(4'-methylcyclohexyl) phenyl group, 4-(4'-tert-butyl cyclohexyl) phenyl group, 3-cyclohexyl phenyl group, 2-cyclohexyl phenyl group, a 4-ethyl-1-naphthyl group, a 6-n-butyl-2-naphthyl group, 2, 4-dimethylphenyl radical, 2, 5-dimethylphenyl radical, 3, 4-dimethylphenyl radical, 3, 5-dimethylphenyl radical, 2, 6-dimethylphenyl radical, 2, 4-diethyl phenyl group, 2, 3, 5-trimethyl phenyl radical, 2 and 3, 6-trimethyl phenyl radical, 3, 4, 5-trimethyl phenyl radical, 2, 6-diethyl phenyl group, 2, 5-diisopropylphenyl radical, 2, a 6-diisobutyl phenyl group, 2, a 4-G tert-buthylphenyl radical, 2, a 5-G tert-buthylphenyl radical, 4, a 6-G tert-butyl-2-methylphenyl radical, a 5-tert-butyl-2-methylphenyl radical, 4-tert-butyl -2, 6-dimethylphenyl radical, a 9-methyl-2-fluorenyl group, A 9-ethyl-2-fluorenyl group, 9-n-hexyl-2-fluorenyl group, 9, and 9-dimethyl-2-fluorenyl group, 9, and 9-diethyl-2-fluorenyl group, 9, and 9-G n-propyl-2-fluorenyl group, [0013] 4-methoxypheny radical, 3-methoxypheny radical, 2-methoxypheny radical, A 4-ethoxy phenyl group, a 3-ethoxy phenyl group, a 2-ethoxy phenyl group, A 4-n-propoxy phenyl group, a 3-n-propoxy phenyl group, 4-isopropoxy phenyl group, 2-isopropoxy phenyl group, a 4-n-butoxy phenyl group, a 4-iso butoxy phenyl group, A 2-sec-butoxy phenyl group, a 4-n-pentyloxy phenyl group, 4-isopentyloxy phenyl group, 2-isopentyloxy phenyl group, A 4-neopentyl oxy-phenyl group, a 2-neopentyl oxy-phenyl group, A 4-n-hexyloxy phenyl group, a 2-(2'-ethyl butyl) oxy-phenyl group, A 4-n-octyloxy phenyl group, a 4-n-decyloxy phenyl group, A 4-n-dodecyloxy phenyl group, a 4-n-tetradecyl oxy-phenyl group, 4-cyclohexyloxy phenyl group, 2-cyclohexyloxy phenyl group, A 2-methoxy-1-naphthyl group, a 4-methoxy-1-naphthyl group, a 4-n-

butoxy-1-naphthyl group, A 5-ethoxy-1-naphthyl group, a 6-methoxy-2-naphthyl group, a 6-ethoxy-2-naphthyl group, A 6-n-butoxy-2-naphthyl group, a 6-n-hexyloxy-2-naphthyl group, A 7-methoxy-2-naphthyl group, a 7-n-butoxy-2-naphthyl group, A 2-methyl-4-methoxypheny radical, a 2-methyl-5-methoxypheny radical, A 3-methyl-4-methoxypheny radical, a 3-methyl-5-methoxypheny radical, A 3-ethyl-5-methoxypheny radical, a 2-methoxy-4-methylphenyl radical, A 3-methoxy-4-methylphenyl radical, 2, 4-dimethoxy phenyl group, 2, 5-dimethoxy phenyl group, 2, 6-dimethoxy phenyl group, 3, 4-dimethoxy phenyl group, 3, 5-dimethoxy phenyl group, 3, 5-diethoxy phenyl group, 3, a 5-G n-butoxy phenyl group, A 2-methoxy-4-ethoxy phenyl group, a 2-methoxy-6-ethoxy phenyl group, 3, 4, 5-trimethoxyphenyl radical, 4-phenyl phenyl group, 3-phenyl phenyl group, 2-phenyl phenyl group, 4-(4'-methylphenyl) phenyl group, 4-(3'-methylphenyl) phenyl group, 4-(4'-methoxypheny) phenyl group, 4-(4'-n-butoxy phenyl) phenyl group, 2-(2'-methoxypheny) phenyl group, 4-(4'-chlorophenyl) phenyl group, a 3-methyl-4-phenyl phenyl group, a 3-methoxy-4-phenyl phenyl group, a 9-phenyl-2-fluorenyl group, [0014] 4-fluoro phenyl group, 3-fluoro phenyl group, 2-fluoro phenyl group, 4-chlorophenyl radical, a 3-chlorophenyl radical, 2-chlorophenyl radical, 4-BUROMO phenyl group, 2-BUROMO phenyl group, a 4-chloro-1-naphthyl group, A 4-chloro-2-naphthyl group, a 6-BUROMO-2-naphthyl group, 2, a 3-difluoro phenyl group, 2, a 4-difluoro phenyl group, 2, a 5-difluoro phenyl group, 2, a 6-difluoro phenyl group, 3, a 4-difluoro phenyl group, 3, 5-JIFURUOROFU An ENIRU radical, 2, 3-dichlorophenyl radical, 2, 4-dichlorophenyl radical, 2, 5-dichlorophenyl radical, 3, 4-dichlorophenyl radical, 3, 5-dichlorophenyl radical, 2, 5-dibromo phenyl group, 2 and 4, 6-TORIKURORO phenyl group, 2, a 4-dichloro-1-naphthyl group, 1, a 6-dichloro-2-naphthyl group, A 2-fluoro-4-methylphenyl radical, a 2-fluoro-5-methylphenyl radical, A 3-fluoro-2-methylphenyl radical, a 3-fluoro-4-methylphenyl radical, A 2-methyl-4-fluoro phenyl group, a 2-methyl-5-fluoro phenyl group, A 3-methyl-4-fluoro phenyl group, a 2-chloro-4-methylphenyl radical, A 2-chloro-5-methylphenyl radical, a 2-chloro-6-methylphenyl radical, A 2-methyl-3-chlorophenyl radical, a 2-methyl-4-chlorophenyl radical, A 3-chloro-4-methylphenyl radical, a 3-methyl-4-chlorophenyl radical, 2-chloro -4, 6-dimethylphenyl radical, a 2-methoxy-4-fluoro phenyl group, A 2-fluoro-4-methoxypheny radical, a 2-fluoro-4-ethoxy phenyl group, A 2-fluoro-6-methoxypheny radical, a 3-fluoro-4-ethoxy phenyl group, Although a 3-chloro-4-methoxypheny radical, a 2-methoxy-5-chlorophenyl radical, a 3-methoxy-6-chlorophenyl radical, 5-chloro -2, 4-dimethoxy phenyl group, etc. can be mentioned, it is not limited to these.

[0015] It sets to the compound expressed with a general formula (1), and is R1. And R2 Hydrogen atom, The aralkyl radical which is not permuted [the aryl group which is not permuted / a straight chain, branching or an annular alkyl group, a permutation, or /, a permutation, or] is expressed. Preferably The aryl group which is not permuted [the permutation of a hydrogen atom, the straight chain of carbon numbers 1-16, branching or an annular alkyl group, and carbon numbers 4-16, or], It is the aralkyl radical which is not permuted [the permutation of carbon numbers 5-16, or]. Or more preferably The aryl group which is not permuted [the permutation of a hydrogen atom, the straight chain of carbon numbers 1-16, branching or an annular alkyl group, and carbon numbers 6-12, or], Or it is the aralkyl radical which is not permuted [the permutation of carbon numbers 7-12, or], and is R1 still more preferably. And R2 They are the straight chain of carbon numbers 1-14, branching or an annular alkyl group, the ring type aromatic series radical of carbon numbers 6-10, or the ring type aralkyl radical of carbon numbers 7-10.

[0016] In addition, R1 And R2 As an example of the aryl group which is not permuted [a permutation or], it is Ar1, for example. And Ar2 The aryl group which is not permuted [the permutation mentioned as an example or] can be illustrated. R1 And R2 As an example of a straight chain, branching, or an annular alkyl group For example, a methyl group, an ethyl group, n-propyl group, an isopropyl group, n-butyl, An isobutyl radical, sec-butyl, tert-butyl, n-pentyl radical, An isopentyl radical, a neopentyl radical, a tert-pentyl radical, a cyclopentylic group, n-hexyl group, 2-ethyl butyl, 3, and 3-dimethyl butyl, Although a cyclohexyl radical, n-heptyl radical, a cyclohexyl methyl group, n-octyl radical, a tert-octyl radical, a 2-ethylhexyl radical, n-nonyl radical, n-decyl group, n-dodecyl, n-tetradecyl radical, n-hexadecyl radical, etc. can be mentioned It is not limited to these. Moreover, R1 And R2 As an example of the aralkyl radical which is not permuted [a permutation or] For example, benzyl, phenethyl radical, alpha-methylbenzyl radical, alpha, and alpha-dimethylbenzyl radical, 1-naphthyl methyl group, 2-naphthyl methyl group, a furfuryl radical, 2-methylbenzyl radical, 3-methylbenzyl radical, 4-methylbenzyl radical, 4-ethyl benzyl, 4-isopropyl benzyl, 4-tert-butyl benzyl, 4-n-hexyl benzyl, 4-nonyl benzyl, 3, 4-dimethylbenzyl radical, 3-methoxybenzyl radical, 4-methoxybenzyl radical, 4-ethoxybenzyl radical, 4-n-butoxy benzyl, Although aralkyl radicals, such as 4-n-hexyloxy benzyl, 4-nonyloxy benzyl, 4-fluoro benzyl, 3-fluoro benzyl, 2-chloro benzyl, and 4-chloro benzyl, etc. can be mentioned, it is not limited to these.

[0017] Z1 And Z2 A hydrogen atom, a halogen atom, a straight chain, branching, or an annular alkyl group, The aryl group which is not permuted [a straight chain, branching, an annular alkoxy group, a permutation, or] is expressed. Preferably A hydrogen atom, a halogen atom, the straight chain of carbon numbers 1-16, branching, or an annular alkyl group, It is the aryl group which is not permuted [the permutation of the straight chain of carbon numbers 1-16, branching, an annular alkoxy group, or carbon numbers 4-20, or]. More preferably It is the aryl group which is not permuted [the permutation of a hydrogen atom, a halogen atom, the straight chain of carbon numbers 1-8, branching or an annular alkyl group, the straight chain of carbon numbers 1-8, branching, an annular alkoxy group, or carbon numbers 6-12, or], and is a hydrogen atom still more preferably.

[0018] In addition, Z1 And Z2 As an example of a straight chain, branching, or an annular alkyl group, it is R1, for example. And R2 The straight chain mentioned as an example, branching, or an annular alkyl group can be illustrated. Moreover, Z1 And Z2 As an example of the aryl group which is not permuted [a permutation or], it is Ar1, for example. And Ar2 The aryl group which is not permuted [the permutation mentioned as an example or] can be illustrated. Z1 And Z2 As an example of a halogen atom, a straight chain, branching, or an annular alkoxy group For

example, halogen atoms, such as a fluorine atom, a chlorine atom, and a bromine atom For example, a methoxy group, an ethoxy radical, n-propoxy group, an isopropoxy group, An n-butoxy radical, an iso butoxy radical, a sec-butoxy radical, an n-pentyloxy radical, An isopentyloxy radical, a neopentyl oxy-radical, a cyclopenthyloxy radical, n-hexyloxy radical, 2-ethyl butoxy radical, 3, and 3-dimethyl butoxy radical, A cyclohexyloxy radical, n-heptyloxy radical, a cyclohexyl methyloxy radical, Alkoxy groups, such as n-octyloxy radical, 2-ethylhexyloxy radical, n-nonyloxy radical, an n-decyloxy radical, n-dodecyloxy radical, n-tetradecyl oxy-radical, and n-hexadecyl oxy-radical, can be mentioned.
[0019] As an example of a compound expressed with the general formula (1) concerning this invention, although the following compounds (** 4 --izing 16) can be mentioned, this invention is not limited to these, for example. In addition, Ph expresses a phenyl group among a formula and Bz expresses benzyl.
[0020]
[Formula 4]
例示化合物番号

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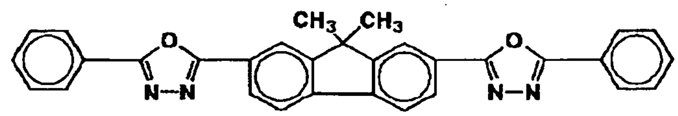

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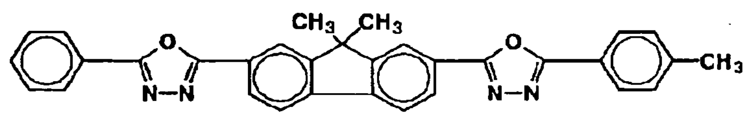

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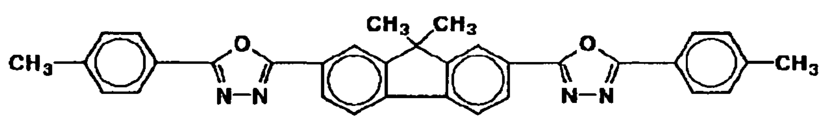

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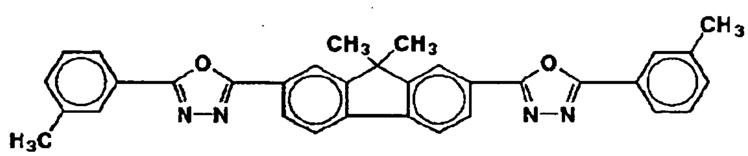

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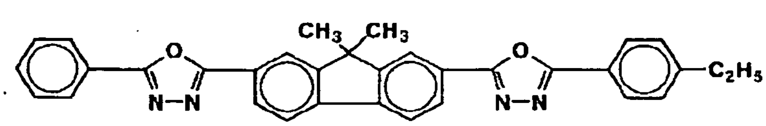
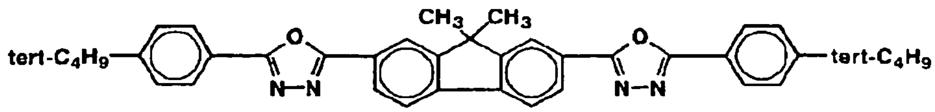
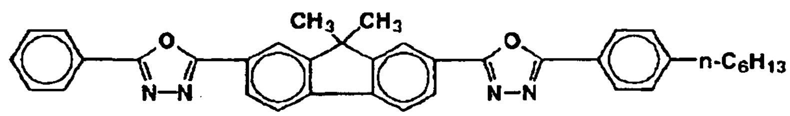
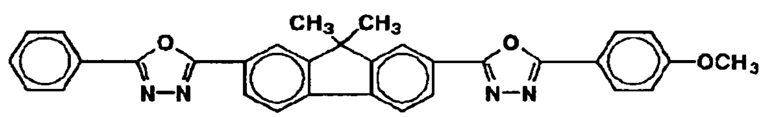
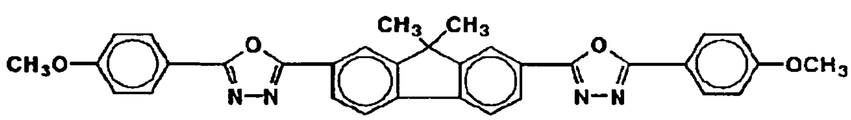


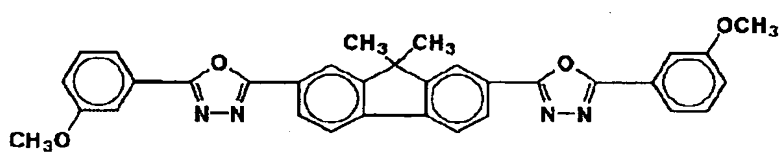
[0021]
[Formula 5]

6 

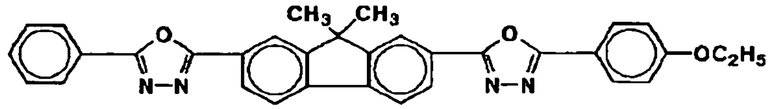
7 

8 

9 

10 

[0022]
[Formula 6]

11


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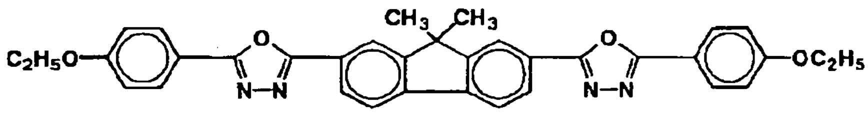

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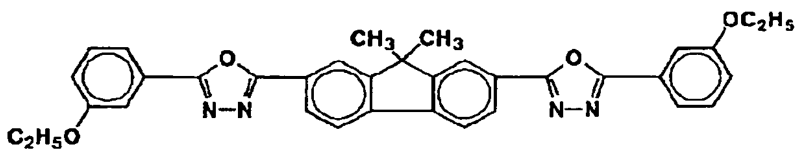

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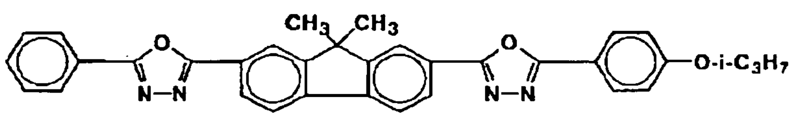

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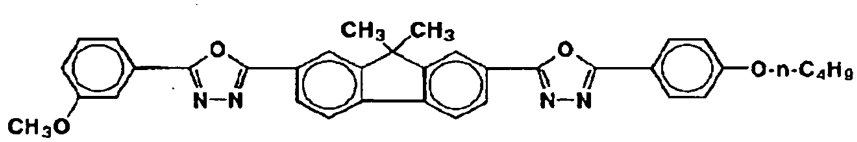
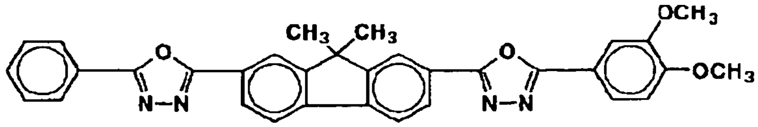
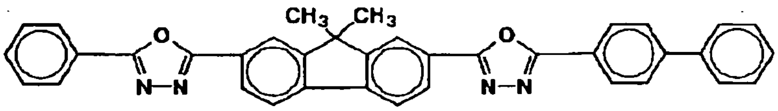
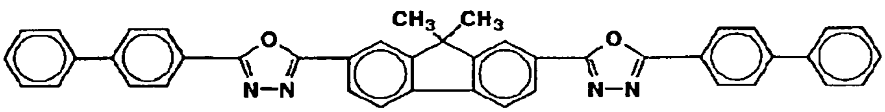
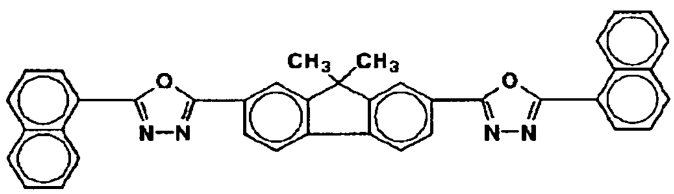


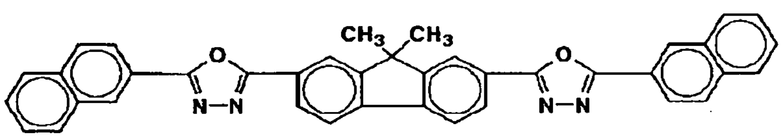
[0023]
[Formula 7]

16 

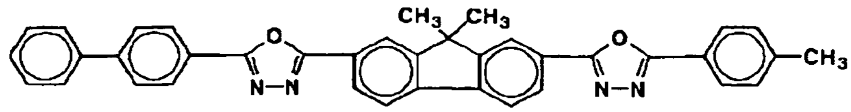
17 

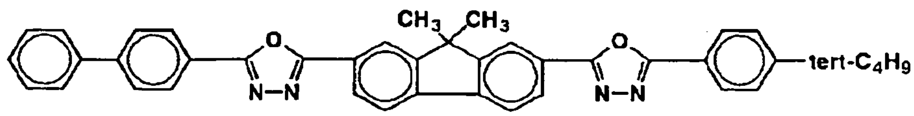
18 

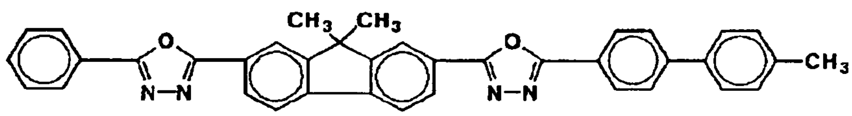
19 

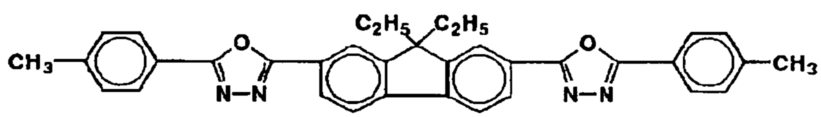
20 

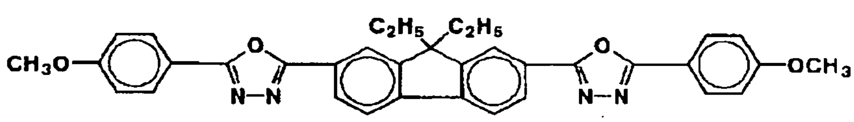
[0024]
[Formula 8]

21 

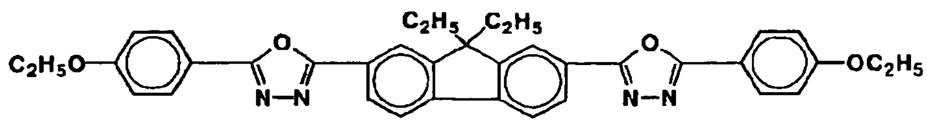
22 

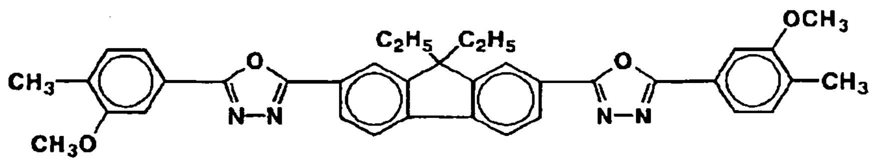
23 

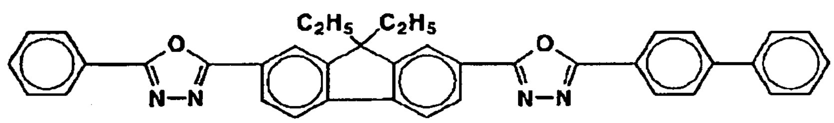
24 

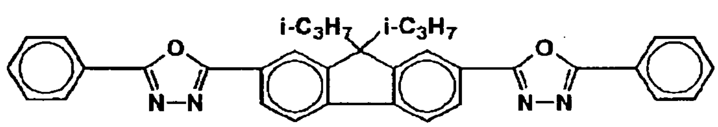
25 

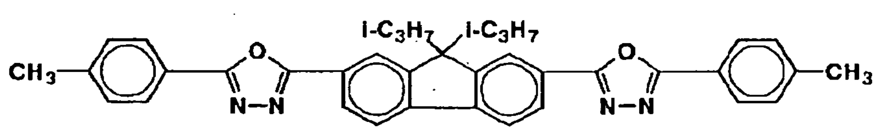
[0025]
[Formula 9]

26 

27 

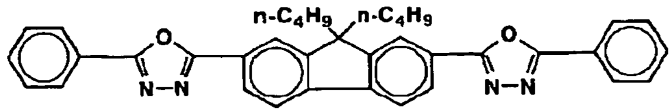
28 

29 

30 

[0026]
[Formula 10]

31



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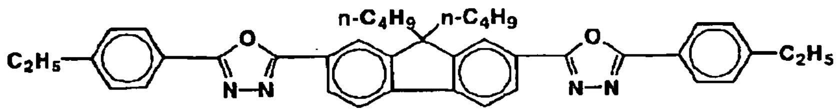

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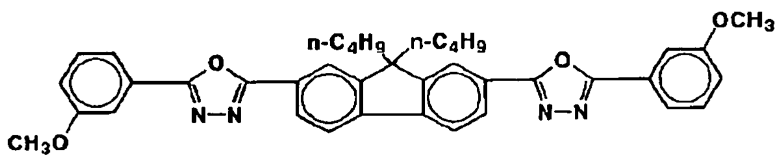

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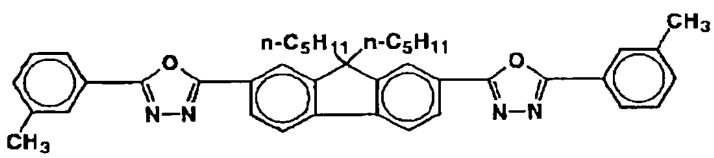

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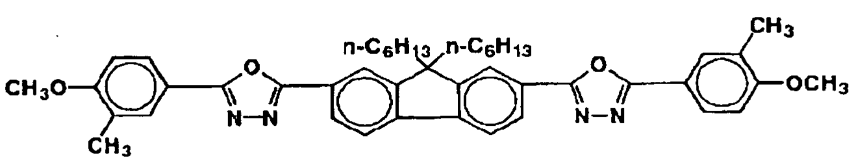
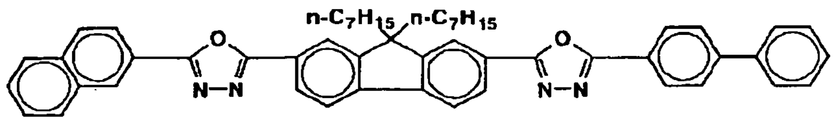
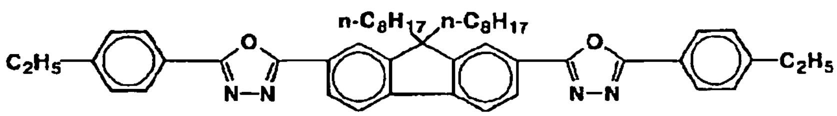
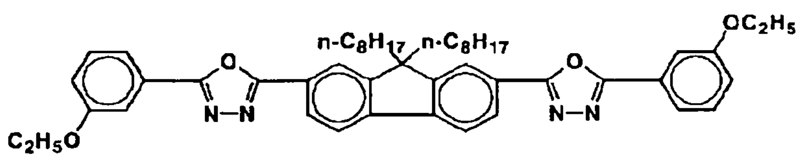
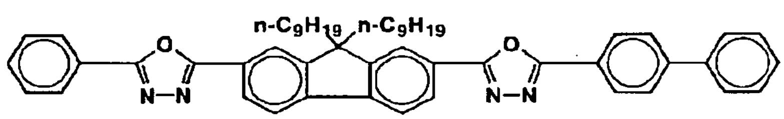


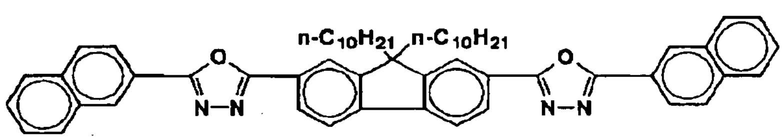
[0027]
[Formula 11]

36 

37 

38 

39 

40 

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[Formula 12]

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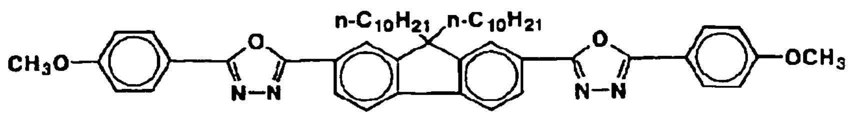

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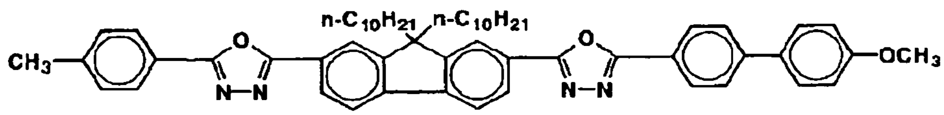

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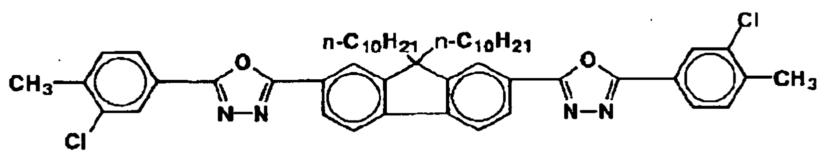

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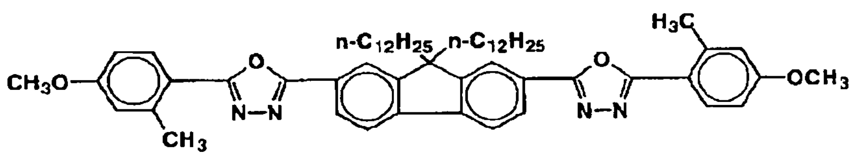

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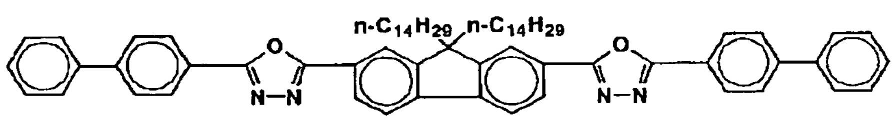
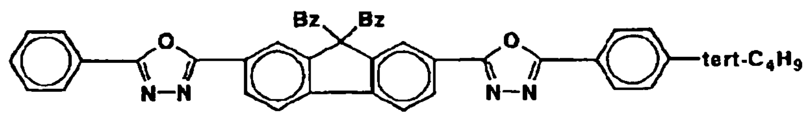
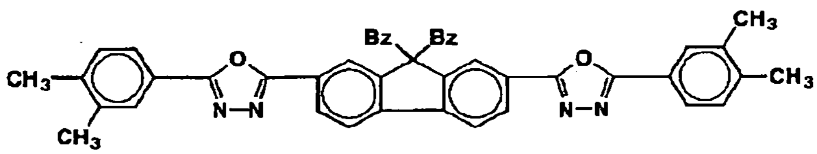
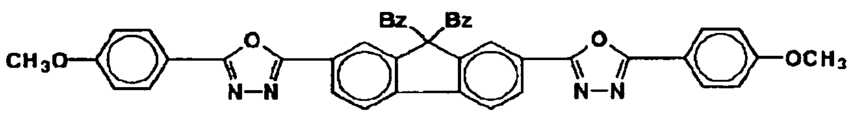
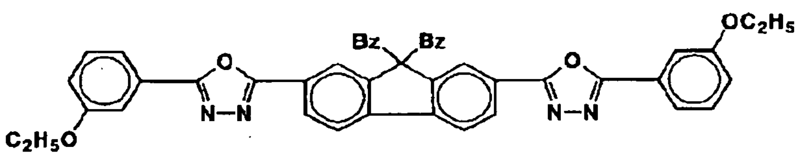


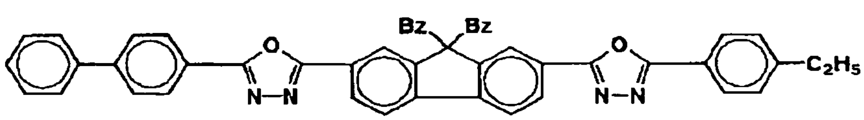
[0029]
[Formula 13]

46 

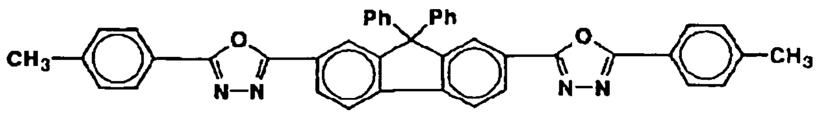
47 

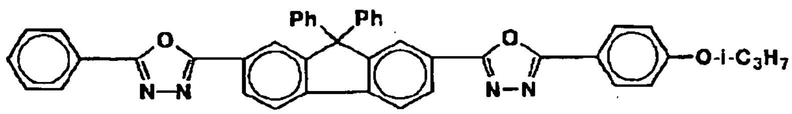
48 

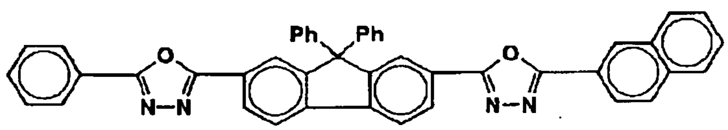
49 

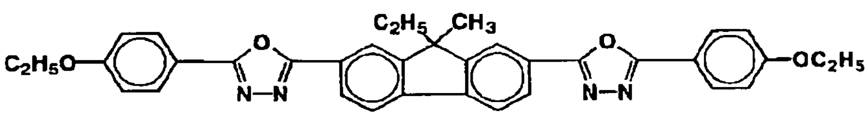
50 

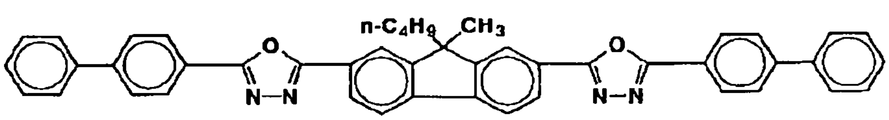
[0030]
[Formula 14]

51 

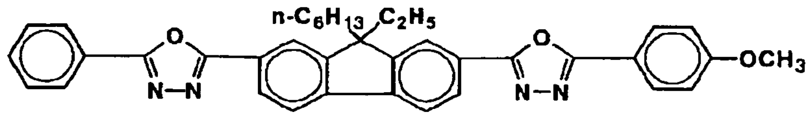
52 

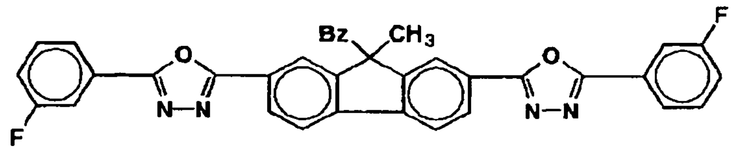
53 

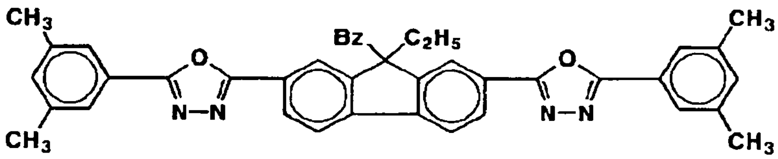
54 

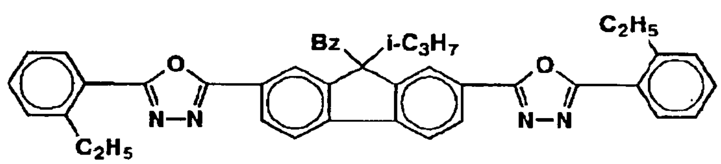
55 

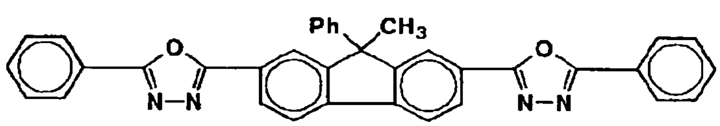
[0031]
[Formula 15]

56 

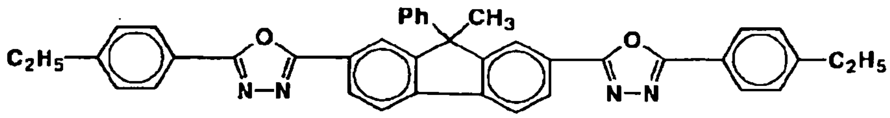
57 

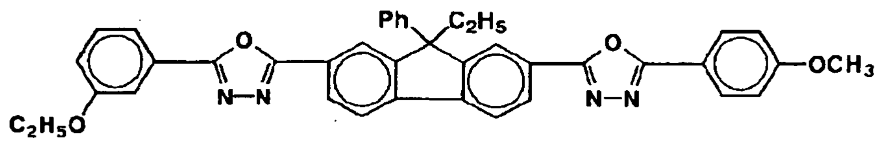
58 

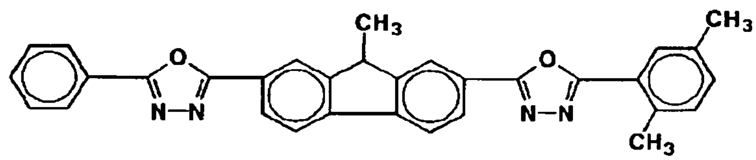
59 

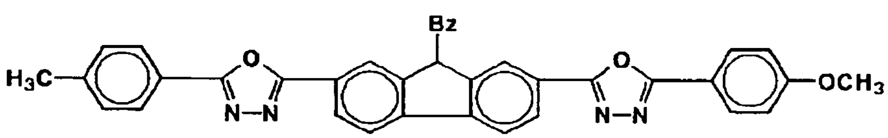
60 

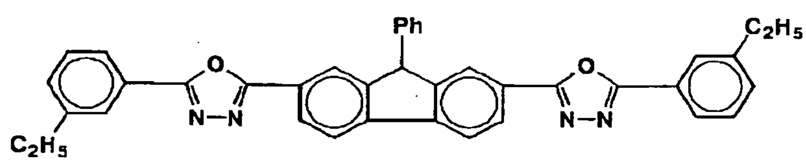
[0032]
[Formula 16]

61 

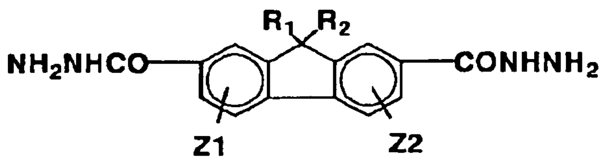
62 

63 

64 

65 

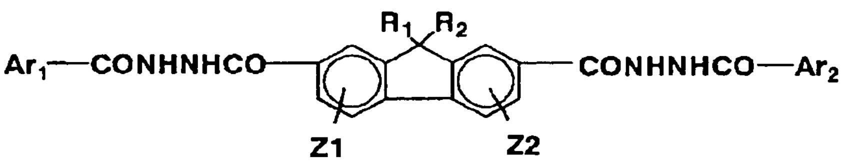
[0033] The compound expressed with the general formula (1) concerning this invention can be itself manufactured by the well-known approach. Namely, for example, a fluorene -2, 7-dicarboxylic acid derivative The compound expressed with the general formula (2) which can be manufactured from for example, (a fluorene -2, 7-dicarboxylic acid halide derivative, a fluorene -2 and 7-dicarboxylic acid ester derivative), and a hydrazine, and (** 17), The compound expressed with a general formula (3) and (** 17) and the compound expressed with a general formula (4) and (** 17) are made to react, and after manufacturing the compound expressed with a general formula (5) and (** 17), it can manufacture by making a dehydrating agent (for example, phosphorus oxychloride) act.
[0034]
[Formula 17]



(2)

$$Ar_1\text{—}COY_1 \quad (3)$$

$$Y_2OC\text{—}Ar_2 \quad (4)$$



(5)

[Among a formula, Y1 and Y2 express a halogen atom, and Ar1, Ar2, R1, R2, Z1, and Z2 express the same semantics as a general formula (1).]
[0035] Organic electroluminescence devices usually come at least to pinch the luminous layer which contains at least one sort of luminescence components in inter-electrode [of a pair] further. In consideration of each functional level of the hole injection of the compound used for a luminous layer and electron hole transportation, electron injection, and electronic transportation, the electron injection transportation layer containing the hole-injection transportation layer and/or electron injection transportation component containing a hole-injection transportation component can also be prepared according to a request. For example, when the hole-injection function of the compound used for a luminous layer, an electron hole transportation function and/or an electron injection function, and an electronic transportation function are good, a luminous layer can consider as the configuration of the component of the mold which served both as the hole-injection transportation layer and/or the electron injection transportation layer. Of course, it can also consider as the configuration of the component (much more component of a mold) of the mold which does not prepare the layer of both a hole-injection transportation layer and an electron injection transportation layer depending on the case. Moreover, a hole-injection transportation layer, an electron injection transportation layer, and each layer of a luminous layer may be structures much more, or may be multilayer structure, in each layer, the layer which has an impregnation function, and the layer which has a transportation function can be prepared separately, and a hole-injection transportation layer and an electron injection transportation layer can also constitute it.
[0036] In the organic electroluminescence devices of this invention, as for the compound expressed with a general formula (1), it is desirable to use for a hole-injection transportation component, a luminescence component, or an electron injection transportation component, and it is more desirable to use for a luminescence component or an electron injection transportation component. In the organic electroluminescence devices of this invention, the compound expressed with a general formula (1) may be used independently, or may be used together. [two or more]
[0037] Especially as a configuration of the organic electroluminescence devices of this invention, it cannot limit and (C) anode plate / luminous layer / electron injection transportation layer / cathode mold component (drawing 3), (D) anode plate / luminous layer / cathode mold component (drawing 4), etc. can be mentioned (drawing 2). (drawing 1) Furthermore, it can also consider as (E) anode plate / hole-injection transportation layer / electron injection transportation layer / luminous layer / electron injection transportation layer / cathode mold component (drawing 5) which is a component of the mold which put the luminous layer in the electron injection transportation layer. (D) Although the component of the mold which made inter-electrode [of a pair] pinch a luminescence component with a gestalt further is included as a component configuration of a mold The component of the mold which it made inter-electrode [of a pair] pinch more preferably with the one-layer gestalt which mixed (F) hole-injection transportation component, the luminescence component, and the electron injection transportation component (drawing 6), (G) It is the component (drawing 8 R> 8) of the mold which it made inter-electrode [of a pair] pinch with the one-layer gestalt which mixed the component (drawing 7) or (H) luminescence component, and the electron injection transportation component of the mold which it made inter-electrode [of a pair] pinch with the one-layer gestalt which mixed the hole-injection transportation component and the luminescence

component.
[0038] The organic electroluminescence devices of this invention cannot be restricted to these component configurations, and can prepare a hole-injection transportation layer, a luminous layer, and a two or more layers electron injection transportation layer in each type of component. Moreover, in each type of component, the mixolimnion of a luminescence component and an electron injection transportation component can also be prepared between a hole-injection transportation layer and a luminous layer between the mixolimnion of a hole-injection transportation component and a luminescence component and/or a luminous layer, and an electron injection transportation layer. The configuration of more desirable organic electroluminescence devices is (A) mold component, (B) mold component, (C) mold component, (E) mold component, (F) mold component, (G) mold component, or (H) mold component, and is (A) mold component, (B) mold component, (C) mold component, or (F) mold component still more preferably.
[0039] As organic electroluminescence devices of this invention, (A) anode plate / hole-injection transportation layer / luminous layer / electron injection transportation layer / cathode mold component shown in (drawing 1) are explained, for example. (drawing 1) -- setting -- 1 -- a substrate and 2 -- in an anode plate and 3, an electron injection transportation layer and 6 show cathode, and, as for a hole-injection transportation layer and 4, 7 shows a power source, as for a luminous layer and 5.
[0040] Being supported by the substrate 1 is desirable, especially as a substrate, although the organic electroluminescence devices of this invention are not limited, transparence thru/or a translucent thing are desirable [electroluminescence devices], for example, they can mention what consists of a compound sheet which combined a glass plate, a transparence sheet plastic (for example, sheets, such as polyester, a polycarbonate, polysulfone, polymethylmethacrylate, polypropylene, and polyethylene), a translucent sheet plastic, a quartz, transparent ceramics, or these. Furthermore, the luminescent color is also controllable to a substrate combining for example, the color filter film, the color conversion film, and the dielectric reflective film.
[0041] As an anode plate 2, it is desirable to use a metal with a comparatively large work function, an alloy, or an electric conductivity compound as electrode material. As electrode material used for an anode plate, gold, platinum, silver, copper, cobalt, nickel, palladium, vanadium, a tungsten, tin oxide, a zinc oxide, ITO (indium Tin oxide), the poly thiophene, polypyrrole, etc. can be mentioned, for example. Such electrode material may be used independently or may be used together. [two or more] An anode plate can form such electrode material on a substrate by approaches, such as vacuum deposition and the sputtering method. Moreover, an anode plate may be structure much more, or may be multilayer structure. The sheet electric resistance of an anode plate is more preferably set as 5-50ohms / ** extent below hundreds of ohms / **. Although the thickness of an anode plate is based also on the ingredient of the electrode material to be used, generally it is more preferably set as about 10-500nm about 5-1000nm.
[0042] The hole-injection transportation layer 3 is a layer containing the compound which has the function to convey the electron hole which makes easy impregnation of the electron hole (hole) from an anode plate, and which was functioned and poured in. A hole-injection transportation layer can be formed using the compounds (for example, a phthalocyanine derivative, a thoria reel methane derivative, a thoria reel amine derivative, an oxazole derivative, a hydrazone derivative, a stilbene derivative, a pyrazoline derivative, a polysilane derivative, polyphenylene vinylene and its derivative, the poly thiophene and its derivative, a Polly N-vinylcarbazole derivative, etc.) which have the compound and/or other hole-injection transportation functions in which it is expressed with a general formula (1) at least one sort. In addition, the compound which has a hole-injection transportation function may be used independently, or may be used together. [two or more]
[0043] As a compound which has other hole-injection transportation functions to use in this invention a thoria reel amine derivative (for example, 4 and 4' screw [-] [N-phenyl-N-(4″-methylphenyl) amino] biphenyl --) 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl, 4 and 4' screw [-] [N-phenyl-N-(3″-methoxypheny) amino] biphenyl, 4 and 4' screw [-] [N-phenyl-N-(1″-naphthyl) amino] biphenyl, 3 and 3' -- the - dimethyl -4 and 4' - screw [N-phenyl-N-(3″-methylphenyl) amino] biphenyl -- 1 and 1-screw [4'-[N and N-JI (4″-methylphenyl) amino] phenyl] cyclohexane, 9, 10-screw [N-(4'-methylphenyl)-N-(4″-n-buthylphenyl) amino] phenanthrene, 3, 8-screw (N and N-diphenylamino)-6-phenyl phenanthridine, four - methyl - N -- N - a screw -- [-- four -- ″ -- four -- ″ -- ' - a screw -- [-- N -- ' -- N -- ' - JI (4-methylphenyl) -- amino --] -- a biphenyl - four - IRU --] -- an aniline -- N, N'-screw [4-(diphenylamino) phenyl]-N, N'-diphenyl -1, 3-diaminobenzene, N, N'-screw [4-(diphenylamino) phenyl]-N, N'-diphenyl -1, 4-diaminobenzene, 5 and 5 ″- screw [4-(screw [4-methylphenyl] amino) phenyl]-2, 2':5', 2″-TACHIOFEN, 1, 3, 5-tris (diphenylamino) benzene, 4, 4', a 4″-tris (N-carbazoyl) triphenylamine, 4, 4', a 4″-tris [N-(3‴-methylphenyl)-N-phenylamino] triphenylamine, The poly thiophene and its derivatives, such as 1, 3, and 5-tris [N-(4'-diphenyl aminophenyl) phenylamino] benzene, and a Polly N-vinylcarbazole derivative are more desirable. When using together the compound expressed with a general formula (1), and the compound which has other hole-injection transportation functions, the rate of a compound of being expressed with the general formula (1) occupied in a hole-injection transportation layer is preferably prepared to about 0.1 - 40% of the weight.
[0044] A luminous layer 4 is a layer containing the compound which has an electron hole and electronic impregnation functions, those transportation functions, and the function to make the recombination of an electron hole and an electron generate an exciton. the compound (for example, an acridone derivative, the Quinacridone derivative, and a polynuclear aromatic compound -- [-- for example) which has the compound and/or other luminescence functions in which a luminous layer is expressed with a general formula (1) Rubrene, an anthracene, tetracene, a pyrene, perylene, a chrysene, Deca cyclene, coronene, a tetra-phenyl cyclopentadiene, a PENTA phenyl

cyclopentadiene, 9, 10-diphenyl anthracene, 9, 10-screw (phenyl ethynyl) anthracene, 1, 4-screw (9'-ethynyl anthracenyl) benzene, 4, and 4'-screw (9''-ethynyl anthracenyl) biphenyl] and a thoria reel amine derivative -- [-- for example] which can mention the compound mentioned above as a compound which has a hole-injection transportation function, and an organometallic complex -- [-- for example Tris (8-quinolate) aluminum, screw (10-benzo[h] quinolate) beryllium, The zinc salt of 2-(2'-hydroxyphenyl) benzooxazole, the zinc salt of 2-(2'-hydroxyphenyl) benzothiazole, the zinc salt of a 4-hydroxy acridine, the zinc salt of a 3-hydroxy flavone, the beryllium salt of a 5-hydroxy flavone, aluminum salt [of a 5-hydroxy flavone]], and a stilbene derivative -- [-- for example 1, 1, 4, and 4-tetra-phenyl-1,3-butadiene, 4, and 4'-screw (2 and 2-diphenyl vinyl) biphenyl] and a coumarin derivative -- [-- for example A coumarin 1, a coumarin 6, a coumarin 7, a coumarin 30, a coumarin 106, a coumarin 138, a coumarin 151, a coumarin 152, a coumarin 153, a coumarin 307, a coumarin 311, a coumarin 314, a coumarin 334, a coumarin 338, a coumarin 343, coumarin 500], a pyran derivative ([DCM1, DCM2]), and oxazone derivative -- [-- for example, [for example,] Nile red], a benzothiazole derivative, a benzooxazole derivative, A benzimidazole derivative, a pyrazine derivative, a cinnamate derivative, Polly N-vinylcarbazole and its derivative, the poly thiophene, and its derivative, Polyphenylene and its derivative, the poly fluorene, and its derivative, Polyphenylene vinylene and its derivative, poly biphenylene vinylene, and its derivative, At least one sort can be formed using poly terphenylene vinylene and its derivative, poly naphthylene vinylene and its derivative, poly thienylene vinylene, its derivative, etc.

[0045] In the organic electroluminescence devices of this invention, it is desirable to contain the compound expressed with a general formula (1) to a luminous layer. When using together the compound expressed with a general formula (1) to a luminous layer, and the compound which has other luminescence functions, the rate of a compound of being expressed with a general formula (1) to the luminous layer occupied in a luminous layer is more preferably prepared to about 0.1 - 99.9% of the weight still more preferably about 0.01 to 99.99% of the weight about 0.001 to 99.999% of the weight.

[0046] As a compound which has other luminescence functions to use in this invention, a luminescent organometallic complex is more desirable. For example, a luminous layer can also consist of a host compound and a guest compound (dopant) like a publication in J.Appl.Phys., 65, 3610 (1989), and JP,5-214332,A. A luminous layer can be formed using the compound expressed with a general formula (1) as a host compound, further, it can use as a guest compound and a luminous layer can also be formed. When forming a luminous layer, using the compound expressed with a general formula (1) as a guest compound, as a host compound, a luminescent organometallic complex is desirable. In this case, to a luminescent organometallic complex, the compound expressed with a general formula (1) is twisted, and is used especially about 0.1 to 10% of the weight about 0.01 to 30% of the weight about 0.001 to 40% of the weight preferably.

[0047] Especially as a luminescent organometallic complex used together with the compound expressed with a general formula (1), although it does not limit, a luminescent organic aluminum complex is desirable and the luminescent organic aluminum complex which has 8-quinolate ligand which is not permuted [a permutation or] is more desirable. As a luminescent desirable organometallic complex, the luminescent organic aluminum complex expressed with a general formula (a) - a general formula (c) can be mentioned, for example.

(Q)3 -Al (a)

(Q expresses among a formula 8-quinolate ligand which is not permuted [a permutation or])

(Q)2 -Al-O-L (b)

(Q expresses a permutation 8-quinolate ligand among a formula, O-L is a phenolate ligand and L expresses the hydrocarbon group of the carbon numbers 6-24 containing a phenyl part)

(Q)2 -Al-O-Al-(Q)2 (c)

(Q expresses a permutation 8-quinolate ligand among a formula)

[0048] As an example of a luminescent organometallic complex, for example Tris (8-quinolate) aluminum, Tris (4-methyl-8-quinolate) aluminum, tris (5-methyl-8-quinolate) aluminum, Tris (3, 4-dimethyl-8-quinolate) aluminum, tris (4, 5-dimethyl-8-quinolate) aluminum, Tris (4, 6-dimethyl-8-quinolate) aluminum, screw (2-methyl-8-quinolate) (phenolate) aluminum, Screw (2-methyl-8-quinolate) (2-methyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3-methyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (4-methyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2-phenyl phenolate) aluminum, screw (2-methyl-8-quinolate) (3-phenyl phenolate) aluminum, [0049] Screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 3-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 6-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3, 4-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3, 5-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3, 5-G tert-butyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 6-diphenyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 4, 6-triphenyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 4, 6-trimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 4, 5, 6-tetramethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (1-naphth RATO) aluminum, Screw (2-methyl-8-quinolate) (2-naphth RATO) aluminum, Screw (2, 4-dimethyl-8-quinolate) (2-phenyl phenolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) (3-phenyl phenolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) (4-phenyl phenolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) (3, 5-dimethyl phenolate) aluminum, screw (2, 4-dimethyl-8-quinolate) (3, 5-G tert-butyl phenolate) aluminum, [0050] Screw (2-methyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-8-quinolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) aluminum-mu-oxo--screw (2, 4-dimethyl-8-quinolate) aluminum, Screw (2-methyl-4-ethyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-4-ethyl-8-quinolate) aluminum, Screw (2-methyl-4-methoxy-8-quinolate) aluminum-mu-oxo--screw (2-methyl-4-methoxy-8-quinolate) aluminum, Screw

(2-methyl-5-cyano-8-quinolate) aluminum-mu-oxo--screw (2-methyl-5-cyano-8-quinolate) aluminum, Screw (2-methyl-5-trifluoromethyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-5-trifluoromethyl-8-quinolate) aluminum etc. can be mentioned. Of course, a luminescent organometallic complex may be used independently or may be used together. [two or more]

[0051] The electron injection transportation layer 5 is a layer containing the compound which has the function to convey the electron which makes impregnation of the electron from cathode easy, and which was functioned and poured in. the compound (for example, an organometallic complex — [— for example) which has the compound and/or other electron injection transportation functions in which an electron injection transportation layer is expressed with a general formula (1) Tris (8-quinolate) aluminum and screw (10-benzo[h] quinolate) beryllium], An OKISA diazole derivative, a triazole derivative, a triazine derivative, a perylene derivative, a quinoline derivative, a quinoxaline derivative, a diphenyl quinone derivative, and nitration full — me — non, at least one sort can be formed using a derivative, a thiopyran dioxide derivative, etc. In the organic electroluminescence devices of this invention, it is desirable to contain the compound expressed with an electron injection transportation layer by the general formula (1). When using together the compound expressed with a general formula (1), and the compound which has other electron injection transportation functions, the rate of a compound of being expressed with the general formula (1) occupied in an electron injection transportation layer is especially prepared to about 0.5 - 20% of the weight preferably about 0.2 to 30% of the weight still more preferably about 0.1 to 40% of the weight more preferably 0.1% of the weight or more. In this invention, it is desirable to use together the compound and organometallic complex [for example, the compound expressed with said general formula (a) - a general formula (c)] which are expressed with a general formula (1), and to form an electron injection transportation layer.

[0052] As cathode 6, it is desirable to use a metal with a comparatively small work function, an alloy, or an electric conductivity compound as electrode material. As electrode material used for cathode, a lithium and lithium-indium alloy, sodium, and sodium-potassium alloy, calcium, magnesium, and magnesium-silver alloy, a magnesium-indium alloy, an indium, a ruthenium, titanium, manganese, an yttrium, aluminum, an aluminium-lithium alloy, an aluminum-calcium alloy, an aluminum magnesium alloy, a graphite thin film, etc. can be mentioned, for example. Such electrode material may be used independently or may be used together. [two or more]

[0053] Cathode can form such electrode material on an electron injection transportation layer by approaches, such as vacuum deposition, the sputtering method, ionization vacuum deposition, the ion plating method, and the ionized cluster beam method. Moreover, cathode may be structure much more or may be multilayer structure. In addition, as for the sheet electric resistance of cathode, it is desirable to set to below hundreds of ohms / **. Although the thickness of cathode is based also on the ingredient of the electrode material to be used, generally it is more preferably set as about 10-500nm about 5-1000nm. In addition, in order to take out luminescence of organic electroluminescence devices efficiently, it is desirable to be transparence thru/or that one [at least] electrode of an anode plate or cathode is translucent, and it is more desirable to set up the ingredient of an anode plate and thickness generally, so that the permeability of luminescence light may become 70% or more.

[0054] moreover, the organic electroluminescence devices of this invention — setting — the — the singlet oxygen quencher may contain in inside further at least. Especially as a singlet oxygen quencher, it does not limit, and rubrene, a nickel complex, diphenyl iso benzofuran, etc. are mentioned, for example, it is rubrene especially preferably. Especially as a layer which the singlet oxygen quencher contains, although it does not limit, it is a luminous layer or a hole-injection transportation layer, and is a hole-injection transportation layer more preferably. In addition, for example, when making a hole-injection transportation layer contain a singlet oxygen quencher, homogeneity may be made to contain in a hole-injection transportation layer, and you may make it contain near a hole-injection transportation layer and the adjoining layer (for example, a luminous layer, the electron injection transportation layer which has a luminescence function). 0.01- of the amount of whole which constitutes the layer (for example, hole-injection transportation layer) to contain as a content of a singlet oxygen quencher — it is 0.1 - 20 % of the weight more preferably 0.05 to 30% of the weight 50% of the weight.

[0055] Especially concerning the formation approach of a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, it cannot limit and can produce by forming a thin film by vacuum evaporation technique, ionization vacuum deposition, and the solution applying methods (for example, a spin coat method, the cast method, a dip coating method, the bar coat method, the roll coat method, a Langmuir-Blodgett method, etc.) for example. Although especially the conditions of vacuum deposition are not limited when forming each class with a vacuum deposition method, it is 0.005 - 50 nm/sec under the vacuum below 10-5Torr extent at the boat temperature (source temperature of vacuum evaporationo) of about 50-400 degrees C, and the substrate temperature of about -50-300 degrees C. It is desirable to carry out with the evaporation rate of extent. In this case, each class, such as a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, can manufacture the organic electroluminescence devices which were further excellent in many properties by forming continuously under a vacuum. When forming each class, such as a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, with a vacuum deposition method using two or more compounds, it is desirable that carry out temperature control of each boat into which the compound was put, and it carries out vapor codeposition according to an individual.

[0056] By the solution applying method, when you form each class, a solvent is dissolved or distributed and let the component which forms each class, its component, binder resin, etc. be coating liquid. As binder resin which can be used for each class of a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer For example, Polly N-vinylcarbazole, polyarylate, polystyrene, Polyester, a polysiloxane,

polymethyl acrylate, polymethylmethacrylate, A polyether, a polycarbonate, a polyamide, polyimide, polyamidoimide, Poly paraxylene, polyethylene, polyphenylene oxide, polyether sulfone, High molecular compounds, such as the poly aniline and its derivative, the poly thiophene and its derivative, polyphenylene vinylene and its derivative, the poly fluorene and its derivative, poly thienylene vinylene, and its derivative, are mentioned. Binder resin may be used independently or may be used together. [two or more]

[0057] When forming each class by the solution applying method, the component which forms each class, its component, binder resin, etc. a suitable organic solvent (for example, a hexane, an octane, Deccan, and toluene --) Hydrocarbon system solvents, such as a xylene, ethylbenzene, and 1-methylnaphthalene, For example, an acetone, a methyl ethyl ketone, methyl isobutyl ketone, Ketone solvent, for example, dichloromethane, such as a cyclohexanone, chloroform, Tetrachloromethane, a dichloroethane, trichloroethane, tetrachloroethane, Halogenated hydrocarbon system solvents, such as a chlorobenzene, a dichlorobenzene, and chloro toluene, For example, ester solvent, such as ethyl acetate, butyl acetate, and amyl acetate, For example, a methanol, propanol, a butanol, a pentanol, a hexanol, Alcoholic solvent, such as a cyclohexanol, methyl cellosolve, ethylcellosolve, and ethylene glycol, For example, ether system solvents, such as dibutyl ether, a tetrahydrofuran, dioxane, and an anisole, For example, N.N-dimethylformamide, N,N-dimethylacetamide, A polar solvent and/or water, such as a 1-methyl-2-pyrrolidone, 1,3-dimethyl-2-imidazolidinone, and dimethyl sulfoxide, can be dissolved or distributed, it can consider as coating liquid, and a thin film can be formed by various kinds of applying methods.

[0058] In addition, especially as an approach of distributing, although it does not limit, it can distribute in the shape of a particle using a ball mill, a sand mill, a paint shaker, attritor, a homogenizer, etc., for example. It cannot limit, can be set as the density range suitable for producing desired thickness by the applying method to enforce, especially concerning the concentration of coating liquid, and, generally is about 1 - 30% of the weight of solution concentration preferably about 0.1 to 50% of the weight. In addition, although it does not limit especially concerning the amount used when using binder resin, generally it sets up to about 15 - 90% of the weight more preferably about 10 to 99% of the weight about 5 to 99.9% of the weight to the component which forms each class (receiving the total amount of each component, in forming the component of a mold further).

[0059] Although it does not limit especially concerning the thickness of a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, generally it is desirable to set it as 5nm - about 5 micrometers. In addition, to the produced component, a protective layer (closure layer) can be prepared, and a component can be enclosed into inactive substances, such as paraffin, a liquid paraffin, a silicone oil, a fluorocarbon oil, and a zeolite content fluorocarbon oil, and can be protected in order to prevent contact with oxygen, moisture, etc. As an ingredient used for a protective layer, for example Organic polymeric materials for example, fluorination resin, an epoxy resin, silicone resin, and epoxy silicone resin -- Polystyrene, polyester, a polycarbonate, a polyamide, polyimide, Polyamidoimide, poly paraxylene, polyethylene, polyphenylene oxide, an inorganic material (for example, diamond thin film, amorphous silica, and electric insulation glass --) A metallic oxide, a metal nitride, a metal carbonization object, metallic sulfide, and the ingredient that can mention a photo-setting resin etc. further and is used for a protective layer may be used independently, or may be used together. [two or more] A protective layer may be structure much more, and may be multilayer structure.

[0060] Moreover, for example, a metal oxide film (for example, aluminum-oxide film) and the metal fluoride film can also be prepared in an electrode as a protective coat. Moreover, for example, the volume phase (interlayer) which consists of an organic phosphorous compound, polysilane, an aromatic amine derivative, and a phthalocyanine derivative can also be prepared on the surface of an anode plate. Furthermore, an electrode, for example, an anode plate, can also process and use the front face with an acid, ammonia/hydrogen peroxide, or the plasma.

[0061] Generally, the organic electroluminescence devices of this invention can be used also as a component of a pulse drive mold or an alternating current drive mold, although used as a component of a direct-current drive mold. In addition, generally applied voltage is about 2-30V. The organic electroluminescence devices of this invention can be used for for example, the panel mold light source, various kinds of light emitting devices, various kinds of display devices, various kinds of indicators, various kinds of sensors, etc.

[0062]

[Example] Hereafter, although an example explains this invention to a detail further, of course, this invention is not limited to these.

The glass substrate which has an ITO transparent electrode (anode plate) with an example 1 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3"-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum and the instantiation compound number 1 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:0.5) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was

impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 55 mA/cm2. The current flowed. Brightness 2450 cd/m2 Luminescence of a bluish green color was checked.
[0063] In two to example 19 example 1, instead of using the compound of the instantiation compound number 1 on the occasion of formation of a luminous layer The compound (example 2) of the instantiation compound number 3, the compound of the instantiation compound number 5 (example 3), The compound (example 4) of the instantiation compound number 6, the compound of the instantiation compound number 9 (example 5), The compound (example 6) of the instantiation compound number 14, the compound of the instantiation compound number 17 (example 7), The compound (example 8) of the instantiation compound number 20, the compound of the instantiation compound number 22 (example 9), The compound (example 10) of the instantiation compound number 26, the compound of the instantiation compound number 30 (example 11), The compound (example 12) of the instantiation compound number 32, the compound of the instantiation compound number 35 (example 13), The compound (example 14) of the instantiation compound number 39, the compound of the instantiation compound number 47 (example 15), Organic electroluminescence devices were produced by the approach of a publication in the example 1 except having used the compound (example 16) of the instantiation compound number 51, the compound (example 17) of the instantiation compound number 54, the compound (example 18) of the instantiation compound number 58, and the compound (example 19) of the instantiation compound number 61. Blue luminescence was checked when the direct current voltage of 12V was impressed to each component under the desiccation ambient atmosphere. Furthermore the property was investigated and the result was shown in the 1st table (Table 1).
[0064] On the occasion of formation of a luminous layer, without using the compound of the instantiation compound number 1, only using screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum, it vapor-deposited in thickness of 50nm, and organic electroluminescence devices were produced by the approach of a publication in the example 1 in example of comparison 1 example 1 except having considered as the luminous layer. Blue luminescence was checked when the direct current voltage of 12V was impressed to this component under the desiccation ambient atmosphere. Furthermore the property was investigated and the result was shown in the 1st table (Table 1).
[0065] In example of comparison 2 example 1, organic electroluminescence devices were produced by the approach of a publication in the example 1 except having used N-methyl-2-methoxy acridone instead of using the compound of the instantiation compound number 1 on the occasion of formation of a luminous layer. Blue luminescence was checked when the direct current voltage of 12V was impressed to this component under the desiccation ambient atmosphere. Furthermore the property was investigated and the result was shown in the 1st table (Table 1).
[0066]
[Table 1]

第１表

有機電界発光素子	輝度 (ｃｄ／ｍ²)	電流密度 (ｍＡ／ｃｍ²)
実施例２	２４６０	５５
実施例３	２４３０	５２
実施例４	２５２０	５５
実施例５	２４６０	５６
実施例６	２５４０	５２
実施例７	２５１０	５３
実施例８	２３２０	５２
実施例９	２４８０	５４
実施例１０	２５２０	５２
実施例１１	２４４０	５６
実施例１２	２４３０	５４
実施例１３	２４７０	５１
実施例１４	２５６０	５３
実施例１５	２４３０	５４
実施例１６	２４６０	５５
実施例１７	２６３０	５２
実施例１８	２４２０	５３
実施例１９	２５６０	５６
比較例１	１１７０	８２
比較例２	１５５０	７４

[0067] The glass substrate which has an ITO transparent electrode (anode plate) with an example 20 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3''-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (2-phenyl phenolate) aluminum and the instantiation compound number 4 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:1.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 58 mA/cm2. The current flowed. Brightness 2450 cd/m2 Blue luminescence was checked.

[0068] The glass substrate which has an ITO transparent electrode (anode plate) with an example 21 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3''-methylphenyl) amino] biphenyl to an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-8-quinolate) aluminum and the instantiation compound number 8 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:2.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of

200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 57 mA/cm2. The current flowed. Brightness 2480 cd/m2 Luminescence of a bluish green color was checked.

[0069] The glass substrate which has an ITO transparent electrode (anode plate) with an example 22 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2, 4-dimethyl-8-quinolate) aluminum-mu-oxo--screw (2, 4-dimethyl-8-quinolate) aluminum and the instantiation compound number 12 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:4.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 60 mA/cm2. The current flowed. Brightness 2460 cd/m2 Blue luminescence was checked.

[0070] The glass substrate which has an ITO transparent electrode (anode plate) with an example 23 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, they are 4, 4', and a 4″-tris [N-(3‴-methylphenyl)-N-phenylamino] triphenylamine on an ITO transparent electrode Evaporation rate 0.1 nm/sec It vapor-deposited in thickness of 30nm, and considered as the first hole-injection transportation layer. Subsequently, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 45nm, and considered as the second hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum and the instantiation compound number 25 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:1.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Furthermore on it, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 58 mA/cm2. The current flowed. Brightness 2840 cd/m2 Blue luminescence was checked.

[0071] The glass substrate which has an ITO transparent electrode (anode plate) with an example 24 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, they are 4, 4', and a 4″-tris [N-(3‴-methylphenyl)-N-phenylamino] triphenylamine on an ITO transparent electrode Evaporation rate 0.1 nm/sec It vapor-deposited in thickness of 30nm, and considered as the first hole-injection transportation layer. Subsequently, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 45nm, and considered as the second hole-injection transportation layer. Subsequently, the compound of the instantiation compound number 24 was vapor-deposited in thickness of 50nm by evaporation rate 0.2 nm/sec on it, and it considered as the luminous layer which served as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 52 mA/cm2. The current flowed. Brightness 1670 cd/m2 Blue luminescence was checked.

[0072] instead of using the compound of the instantiation compound number 24 in example of comparison 3 example 24 on the occasion of formation of the luminous layer which served as the electron injection transportation layer -- 1 and 3-screw [5'-(p-N and N-dimethylamino phenyl)- 1, 3, and 4-OKISA diazole-2' -- organic electroluminescence devices were produced by the approach of a publication in the example 24 except having used - IRU] benzene. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 55 mA/cm2. The current flowed. Brightness 1180 cd/m2 Blue luminescence was checked.

[0073] The glass substrate which has an ITO transparent electrode (anode plate) with an example 25 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, they are 4, 4', and a 4"-tris [N-(3"'-methylphenyl)-N-phenylamino] triphenylamine on an ITO transparent electrode Evaporation rate 0.1 nm/sec It vapor-deposited in thickness of 30nm, and considered as the first hole-injection transportation layer. Subsequently, it is 4 and 4' screw [-] [N-phenyl-N-(3"-methylphenyl) amino] biphenyl on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 45nm, and considered as the second hole-injection transportation layer. Subsequently, it is a 1, 1, 4, and 4-tetra-phenyl butadiene on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the luminous layer. Subsequently, on it, the compound of the instantiation compound number 31 was vapor-deposited in thickness of 50nm by evaporation rate 0.2 nm/sec, and was used as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 52 mA/cm2. The current flowed. Brightness 1370 cd/m2 Blue luminescence was checked. After saving this component in ten days and under a desiccation ambient atmosphere, when the electrical potential difference was impressed under the same conditions, the same luminescence brightness was observed.
[0074] instead of using the compound of the instantiation compound number 31 on the occasion of formation of an electron injection transportation layer in example of comparison 4 example 25 -- 2'-(4"-phenyl phenyl)-5'-(p-tert-buthylphenyl)- organic electroluminescence devices were produced by the approach of a publication in the example 25 except having used 1, 3, and 4-OKISA diazole. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 55 mA/cm2. The current flowed. Brightness 980 cd/m2 Blue luminescence was checked. Luminescence was not observed when the electrical potential difference was impressed under the same conditions, after saving this component in two days and under a desiccation ambient atmosphere.
[0075] The glass substrate which has an ITO transparent electrode (anode plate) with an example 26 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3"-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum and the instantiation compound number 10 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:1.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. subsequently, a it top -- 1 and 3-screw [5'-(p-tert-buthylphenyl)- 1, 3, and 4-OKISA diazole-2' - IRU] benzene -- evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 48 mA/cm2. The current flowed. Brightness 1930 cd/m2 Blue luminescence was checked.
[0076] The glass substrate which has an ITO transparent electrode (anode plate) with an example 27 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. The substrate was dried using nitrogen gas and UV / ozone washing was carried out further. On an ITO transparent electrode, next, Polly N-vinylcarbazole (weight average molecular weight 150000), The compound of the instantiation compound number 33, a coumarin 6 "a [3-(2'-benzothiazolyl)-7-diethylamino coumarin]" (green luminescence component), And DCM1 "a [4-(dicyanomethylene)-2-methyl-6-(4'-dimethylaminostyryl)-4H-pyran]" (orange luminescence component) The luminous layer with a thickness of 400nm was formed with the dip coating method using the 3-% of the weight dichloroethane solution contained at a rate of the weight ratio 100:5:3:2, respectively. Next, after fixing to the substrate electrode holder of vacuum evaporationo equipment the glass substrate which has this luminous layer, the vacuum evaporationo tub was decompressed to 3x10-6Torr. furthermore, a luminous layer top -- 3-(4'-tert-buthylphenyl)-4-phenyl -- 5-(4"-biphenyl)- 1, 2, and 4-triazole -- evaporation rate 0.2 nm/sec after vapor-depositing in thickness of 20nm -- further -- a it top -- tris (8-quinolate) aluminum -- evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 30nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 74 mA/cm2. The current flowed. Brightness 1370 cd/m2 White luminescence was checked.
[0077] The glass substrate which has an ITO transparent electrode (anode plate) with an example 28 thickness of

200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. The substrate was dried using nitrogen gas and UV / ozone washing was carried out further. On an ITO transparent electrode, next, a polycarbonate (weight average molecular weight 50000), 4 and 4' screw [-] [N-phenyl-N-(3''-methylphenyl) amino] biphenyl, The compound of screw (2-methyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-8-quinolate) aluminum and the instantiation compound number 45 The luminous layer with a thickness of 300nm was formed with the dip coating method using the 3-% of the weight dichloroethane solution contained at a rate of the weight ratio 100:40:60:1, respectively. Next, after fixing to the substrate electrode holder of vacuum evaporationo equipment the glass substrate which has this luminous layer, the vacuum evaporationo tub was decompressed to 3x10-6Torr. Furthermore, they are magnesium and silver on a luminous layer Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. When the direct current voltage of 15V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 66 mA/cm2. The current flowed. Brightness 740 cd/m2 Blue luminescence was checked.

[0078]

[Effect of the Invention] It became possible to offer organic electroluminescence devices excellent in luminescence brightness by this invention.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to organic electroluminescence devices.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Conventionally, although inorganic electroluminescence devices have been used as the panel mold light sources, such as a back light, in order to make this light emitting device drive, the high voltage of an alternating current is required for them. Recently came and the organic electroluminescence devices (an organic electroluminescent element: organic EL device) which used the organic material for luminescent material were developed [Appl.Phys.Lett., 51, and 913 (1987)]. Organic electroluminescence devices are components which emit light using the light which has the structure pinched between an anode plate and cathode in the thin film containing a fluorescence organic compound, injects an electron and an electron hole (hole) into this thin film, and is emitted in case an exciton (exciton) is made to generate and this exciton deactivates by making it recombine. organic electroluminescence devices — severalV- dozens — it is the low battery of about V direct current, and luminescence of various colors (for example, red, blue, green) is possible by being able to emit light and choosing the class of fluorescence organic compound. As for the organic electroluminescence devices which have such a description, the application to various light emitting devices, a display device, etc. is expected. However, generally, luminescence brightness is low and is not enough practically.
[0003] As an approach of raising luminescence brightness, the organic electroluminescence devices which used for example, tris (8-quinolate) aluminum as a luminous layer, and used the host compound, the coumarin derivative, and the pyran derivative as a guest compound (dopant) are proposed [J.Appl.Phys., 65, and 3610 (1989)]. Moreover, organic electroluminescence devices were using for example, screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum as a luminous layer, and using the host compound and the acridone derivative (for example, N-methyl-2-methoxy acridone) as a guest compound are proposed (JP,8-67873,A). moreover, a luminous layer — OKISA diazole derivative, 1 [for example,], and 3-screw [5'-(p-N and N-dimethylamino phenyl)- 1, 3, and 4-OKISA diazole-2' — [Jpn.J.Appl.Phys.31, 1812] as which the organic electroluminescence devices using - IRU] benzene are proposed (1992). However, these light emitting devices are also hard to be referred to as having sufficient luminescence brightness.
[0004] moreover, an electron injection transportation layer — 2'-(4''-phenyl phenyl)-5'-(p-tert-buthylphenyl)- [Appl.Phys.Lett., 55, and 1489] as which the organic electroluminescence devices using 1, 3, and 4-OKISA diazole are proposed (1989). However, the preservation stability of this light emitting device is very bad, and hard to be called practical component. In current, organic electroluminescence devices by which preservation stability was improved and which emit light in high brightness further are desired.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] It became possible to offer organic electroluminescence devices excellent in luminescence brightness by this invention.

[Translation done.]

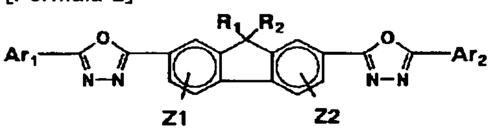
TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The technical problem of this invention is offering the organic electroluminescence devices which are excellent in luminous efficiency and emit light in high brightness.

[Translation done.]

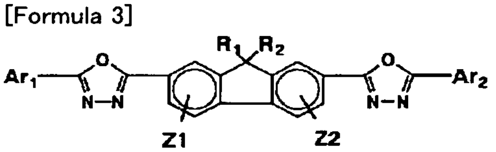
MEANS

[Means for Solving the Problem] this invention person etc. came to complete this invention, as a result of examining organic electroluminescence devices wholeheartedly. That is, this invention is the organic electroluminescence devices which come at least to pinch the layer containing at least one sort of compounds expressed with a general formula (1) and (** 2) to inter-electrode [of ** pair] further, and [0007].
[Formula 2]



(1)

(Among a formula, Ar1 and Ar2 express the aryl group which is not permuted [a permutation or], R1 and R2 express the aralkyl radical which is not permuted [the aryl group which is not permuted / a hydrogen atom, a straight chain branching or an annular alkyl group, a permutation, or / a permutation, or], and Z1 and Z2 express the aryl group which is not permuted [a hydrogen atom, a halogen atom, a straight chain, branching or an annular alkyl group, a straight chain, branching, an annular alkoxy group, a permutation, or])
** The organic electroluminescence devices given [aforementioned] in ** the given layer containing the compound expressed with a general formula (1) is a luminous layer, ** The organic electroluminescence devices given [aforementioned] in ** the given layer containing the compound expressed with a general formula (1) is an electron injection transportation layer, ** Organic electroluminescence devices given in either the aforementioned ** to which the layer containing the compound expressed with a general formula (1) is further characterized by containing a luminescent organometallic complex - **, ** It is further related with inter-electrode [of organic electroluminescence devices given in either the aforementioned ** which has a hole-injection transportation layer - **, and ** pair] at organic electroluminescence devices given in either the aforementioned ** which has an electron injection transportation layer - ** inter-electrode [of a pair].
[0008]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail. The organic electroluminescence devices of this invention come at least to pinch the layer containing at least one sort of compounds expressed with a general formula (1) and (** 3) to inter-electrode [of a pair] further.
[0009]
[Formula 3]



(1)

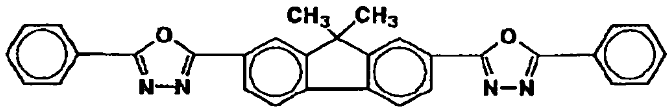
(Among a formula, Ar1 and Ar2 express the aryl group which is not permuted [a permutation or], R1 and R2 express the aralkyl radical which is not permuted [the aryl group which is not permuted / a hydrogen atom, a straight chain branching or an annular alkyl group, a permutation, or / a permutation, or], and Z1 and Z2 express the aryl group which is not permuted [a hydrogen atom, a halogen atom, a straight chain, branching or an annular alkyl group, a straight chain, branching, an annular alkoxy group, a permutation, or])
[0010] It sets to the compound expressed with a general formula (1), and is Ar1. And Ar2 The aryl group which is not permuted [a permutation or] is expressed. In addition, an aryl group expresses heterocycle type aromatic series radicals, such as ring type aromatic series radicals, for example, a furil radical, such as a phenyl group, a naphthyl group, and an anthryl radical, a thienyl group, and a pyridyl radical.
[0011] Ar1 And Ar2 desirable -- un-permuting -- or As a substituent, for example, a halogen atom, an alkyl group, an alkoxy group, They are a ring type aromatic series radical with a single permutation or 6-20 total carbon which may be many permuted, or a heterocycle type aromatic series radical with 3-20 total carbon in an aryl group. Or more preferably Un-permuting or a halogen atom, the alkyl group of carbon numbers 1-14, the alkoxy group of carbon numbers 1-14, It is a ring type aromatic series radical with a single permutation or 6-20 total carbon which may be many permuted in the aryl group of carbon numbers 6-10. Or still more preferably It is a ring type aromatic series radical with a single permutation or 6-16 total carbon which may be many permuted in un-permuting or a

halogen atom, the alkyl group of carbon numbers 1-4, the alkoxy group of carbon numbers 1-4, or the aryl group of carbon numbers 6-10.
[0012] Ar1 And Ar2 As an example, for example A phenyl group, 1-naphthyl group, 2-naphthyl group, 2-anthryl radical, 9-anthryl radical, 2-fluorenyl group, 4-quinolyl radical, 4-pyridyl radical, 3-pyridyl radical, 2-pyridyl radical, 3-furil radical, 2-furil radical, 3-thienyl group, 2-thienyl group, 2-oxazolyl radical, 2-thiazolyl radical, 2-benzoxazolyl radical, 2-benzothiazolyl radical, 2-benzoimidazolyl radical, 4-methylphenyl radical, 3-methylphenyl radical, 2-methylphenyl radical, 4-ethyl phenyl group, 3-ethyl phenyl group, 2-ethyl phenyl group, a 4-n-propyl phenyl group, 4-isopropyl phenyl group, 2-isopropyl phenyl group, a 4-n-buthylphenyl radical, 4-isobutyl phenyl group, A 4-sec-buthylphenyl radical, a 2-sec-buthylphenyl radical, A 4-tert-buthylphenyl radical, a 3-tert-buthylphenyl radical, A 2-tert-buthylphenyl radical, a 4-n-pentyl phenyl group, 4-isopentyl phenyl group, A 2-neopentyl phenyl group, a 4-tert-pentyl phenyl group, A 4-n-hexyl phenyl group, 4-(2'-ethyl butyl) phenyl group, A 4-n-heptyl phenyl group, a 4-n-octyl phenyl group, 4-(2'-ethylhexyl) phenyl group, A 4-tert-octyl phenyl group, a 4-n-DESHIRU phenyl group, a 4-n-dodecyl phenyl group, A 4-n-tetradecyl phenyl group, 4-cyclopentyl phenyl group, 4-cyclohexyl phenyl group, 4-(4'-methylcyclohexyl) phenyl group, 4-(4'-tert-butyl cyclohexyl) phenyl group, 3-cyclohexyl phenyl group, 2-cyclohexyl phenyl group, a 4-ethyl-1-naphthyl group, a 6-n-butyl-2-naphthyl group, 2, 4-dimethylphenyl radical, 2, 5-dimethylphenyl radical, 3, 4-dimethylphenyl radical, 3, 5-dimethylphenyl radical, 2, 6-dimethylphenyl radical, 2, 4-diethyl phenyl group, 2, 3, 5-trimethyl phenyl radical, 2 and 3, 6-trimethyl phenyl radical, 3, 4, 5-trimethyl phenyl radical, 2, 6-diethyl phenyl group, 2, 5-diisopropylphenyl radical, 2, a 6-diisobutyl phenyl group, 2, a 4-G tert-buthylphenyl radical, 2, a 5-G tert-buthylphenyl radical, 4, a 6-G tert-butyl-2-methylphenyl radical, a 5-tert-butyl-2-methylphenyl radical, 4-tert-butyl -2, 6-dimethylphenyl radical, a 9-methyl-2-fluorenyl group, A 9-ethyl-2-fluorenyl group, 9-n-hexyl-2-fluorenyl group, 9, and 9-dimethyl-2-fluorenyl group, 9, and 9-diethyl-2-fluorenyl group, 9, and 9-G n-propyl-2-fluorenyl group, [0013] 4-methoxypheny radical, 3-methoxypheny radical, 2-methoxypheny radical, A 4-ethoxy phenyl group, a 3-ethoxy phenyl group, a 2-ethoxy phenyl group, A 4-n-propoxy phenyl group, a 3-n-propoxy phenyl group, 4-isopropoxy phenyl group, 2-isopropoxy phenyl group, a 4-n-butoxy phenyl group, a 4-iso butoxy phenyl group, A 2-sec-butoxy phenyl group, a 4-n-pentyloxy phenyl group, 4-isopentyloxy phenyl group, 2-isopentyloxy phenyl group, A 4-neopentyl oxy-phenyl group, a 2-neopentyl oxy-phenyl group, A 4-n-hexyloxy phenyl group, a 2-(2'-ethyl butyl) oxy-phenyl group, A 4-n-octyloxy phenyl group, a 4-n-decyloxy phenyl group, A 4-n-dodecyloxy phenyl group, a 4-n-tetradecyl oxy-phenyl group, 4-cyclohexyloxy phenyl group, 2-cyclohexyloxy phenyl group, A 2-methoxy-1-naphthyl group, a 4-methoxy-1-naphthyl group, a 4-n-butoxy-1-naphthyl group, A 5-ethoxy-1-naphthyl group, a 6-methoxy-2-naphthyl group, a 6-ethoxy-2-naphthyl group, A 6-n-butoxy-2-naphthyl group, a 6-n-hexyloxy-2-naphthyl group, A 7-methoxy-2-naphthyl group, a 7-n-butoxy-2-naphthyl group, A 2-methyl-4-methoxypheny radical, a 2-methyl-5-methoxypheny radical, A 3-methyl-4-methoxypheny radical, a 3-methyl-5-methoxypheny radical, A 3-ethyl-5-methoxypheny radical, a 2-methoxy-4-methylphenyl radical, A 3-methoxy-4-methylphenyl radical, 2, 4-dimethoxy phenyl group, 2, 5-dimethoxy phenyl group, 2, 6-dimethoxy phenyl group, 3, 4-dimethoxy phenyl group, 3, 5-dimethoxy phenyl group, 3, 5-diethoxy phenyl group, 3, a 5-G n-butoxy phenyl group, A 2-methoxy-4-ethoxy phenyl group, a 2-methoxy-6-ethoxy phenyl group, 3, 4, 5-trimethoxyphenyl radical, 4-phenyl phenyl group, 3-phenyl phenyl group, 2-phenyl phenyl group, 4-(4'-methylphenyl) phenyl group, 4-(3'-methylphenyl) phenyl group, 4-(4'-methoxypheny) phenyl group, 4-(4'-n-butoxy phenyl) phenyl group, 2-(2'-methoxypheny) phenyl group, 4-(4'-chlorophenyl) phenyl group, a 3-methyl-4-phenyl phenyl group, a 3-methoxy-4-phenyl phenyl group, a 9-phenyl-2-fluorenyl group, [0014] 4-fluoro phenyl group, 3-fluoro phenyl group, 2-fluoro phenyl group, 4-chlorophenyl radical, a 3-chlorophenyl radical, 2-chlorophenyl radical, 4-BUROMO phenyl group, 2-BUROMO phenyl group, a 4-chloro-1-naphthyl group, A 4-chloro-2-naphthyl group, a 6-BUROMO-2-naphthyl group, 2, a 3-difluoro phenyl group, 2, a 4-difluoro phenyl group, 2, a 5-difluoro phenyl group, 2, a 6-difluoro phenyl group, 3, a 4-difluoro phenyl group, 3, 5-JIFURUOROFU An ENIRU radical, 2, 3-dichlorophenyl radical, 2, 4-dichlorophenyl radical, 2, 5-dichlorophenyl radical, 3, 4-dichlorophenyl radical, 3, 5-dichlorophenyl radical, 2, 5-dibromo phenyl group, 2 and 4, 6-TORIKURORO phenyl group, 2, a 4-dichloro-1-naphthyl group, 1, a 6-dichloro-2-naphthyl group, A 2-fluoro-4-methylphenyl radical, a 2-fluoro-5-methylphenyl radical, A 3-fluoro-2-methylphenyl radical, a 3-fluoro-4-methylphenyl radical, A 2-methyl-4-fluoro phenyl group, a 2-methyl-5-fluoro phenyl group, A 3-methyl-4-fluoro phenyl group, a 2-chloro-4-methylphenyl radical, A 2-chloro-5-methylphenyl radical, a 2-chloro-6-methylphenyl radical, A 2-methyl-3-chlorophenyl radical, a 2-methyl-4-chlorophenyl radical, A 3-chloro-4-methylphenyl radical, a 3-methyl-4-chlorophenyl radical, 2-chloro -4, 6-dimethylphenyl radical, a 2-methoxy-4-fluoro phenyl group, A 2-fluoro-4-methoxypheny radical, a 2-fluoro-4-ethoxy phenyl group, A 2-fluoro-6-methoxypheny radical, a 3-fluoro-4-ethoxy phenyl group, Although a 3-chloro-4-methoxypheny radical, a 2-methoxy-5-chlorophenyl radical, a 3-methoxy-6-chlorophenyl radical, 5-chloro -2, 4-dimethoxy phenyl group, etc. can be mentioned, it is not limited to these.
[0015] It sets to the compound expressed with a general formula (1), and is R1. And R2 Hydrogen atom, The aralkyl radical which is not permuted [the aryl group which is not permuted / a straight chain, branching or an annular alkyl group, a permutation, or /, a permutation, or] is expressed. Preferably The aryl group which is not permuted [the permutation of a hydrogen atom, the straight chain of carbon numbers 1-16, branching or an annular alkyl group, and carbon numbers 4-16, or], It is the aralkyl radical which is not permuted [the permutation of carbon numbers 5-16, or]. Or more preferably The aryl group which is not permuted [the permutation of a hydrogen atom, the straight chain of carbon numbers 1-16, branching or an annular alkyl group, and carbon numbers 6-12, or], Or it is the aralkyl radical which is not permuted [the permutation of carbon numbers 7-12, or], and is R1 still more preferably. And R2 They are the straight chain of carbon numbers 1-14, branching or an annular alkyl group, the ring type

aromatic series radical of carbon numbers 6-10, or the ring type aralkyl radical of carbon numbers 7-10.
[0016] In addition, R1 And R2 As an example of the aryl group which is not permuted [a permutation or], it is Ar1, for example. And Ar2 The aryl group which is not permuted [the permutation mentioned as an example or] can be illustrated. R1 And R2 As an example of a straight chain, branching, or an annular alkyl group For example, a methyl group, an ethyl group, n-propyl group, an isopropyl group, n-butyl, An isobutyl radical, sec-butyl, tert-butyl, n-pentyl radical, An isopentyl radical, a neopentyl radical, a tert-pentyl radical, a cyclopentylic group, n-hexyl group, 2-ethyl butyl, 3, and 3-dimethyl butyl, Although a cyclohexyl radical, n-heptyl radical, a cyclohexyl methyl group, n-octyl radical, a tert-octyl radical, a 2-ethylhexyl radical, n-nonyl radical, n-decyl group, n-dodecyl, n-tetradecyl radical, n-hexadecyl radical, etc. can be mentioned It is not limited to these. Moreover, R1 And R2 As an example of the aralkyl radical which is not permuted [a permutation or] For example, benzyl, phenethyl radical, alpha-methylbenzyl radical, alpha, and alpha-dimethylbenzyl radical, 1-naphthyl methyl group, 2-naphthyl methyl group, a furfuryl radical, 2-methylbenzyl radical, 3-methylbenzyl radical, 4-methylbenzyl radical, 4-ethyl benzyl, 4-isopropyl benzyl, 4-tert-butyl benzyl, 4-n-hexyl benzyl, 4-nonyl benzyl, 3, 4-dimethylbenzyl radical, 3-methoxybenzyl radical, 4-methoxybenzyl radical, 4-ethoxybenzyl radical, 4-n-butoxy benzyl, Although aralkyl radicals, such as 4-n-hexyloxy benzyl, 4-nonyloxy benzyl, 4-fluoro benzyl, 3-fluoro benzyl, 2-chloro benzyl, and 4-chloro benzyl, etc. can be mentioned, it is not limited to these.
[0017] Z1 And Z2 A hydrogen atom, a halogen atom, a straight chain, branching, or an annular alkyl group, The aryl group which is not permuted [a straight chain, branching, an annular alkoxy group, a permutation, or] is expressed. Preferably A hydrogen atom, a halogen atom, the straight chain of carbon numbers 1-16, branching, or an annular alkyl group, It is the aryl group which is not permuted [the permutation of the straight chain of carbon numbers 1-16, branching, an annular alkoxy group, or carbon numbers 4-20, or]. More preferably It is the aryl group which is not permuted [the permutation of a hydrogen atom, a halogen atom, the straight chain of carbon numbers 1-8, branching or an annular alkyl group, the straight chain of carbon numbers 1-8, branching, an annular alkoxy group, or carbon numbers 6-12, or], and is a hydrogen atom still more preferably.
[0018] In addition, Z1 And Z2 As an example of a straight chain, branching, or an annular alkyl group, it is R1, for example. And R2 The straight chain mentioned as an example, branching, or an annular alkyl group can be illustrated. Moreover, Z1 And Z2 As an example of the aryl group which is not permuted [a permutation or], it is Ar1, for example. And Ar2 The aryl group which is not permuted [the permutation mentioned as an example or] can be illustrated. Z1 And Z2 As an example of a halogen atom, a straight chain, branching, or an annular alkoxy group For example, halogen atoms, such as a fluorine atom, a chlorine atom, and a bromine atom For example, a methoxy group, an ethoxy radical, n-propoxy group, an isopropoxy group, An n-butoxy radical, an iso butoxy radical, a sec-butoxy radical, an n-pentyloxy radical, An isopentyloxy radical, a neopentyl oxy-radical, a cyclopenthyloxy radical, n-hexyloxy radical, 2-ethyl butoxy radical, 3, and 3-dimethyl butoxy radical, A cyclohexyloxy radical, n-heptyloxy radical, a cyclohexyl methyloxy radical, Alkoxy groups, such as n-octyloxy radical, 2-ethylhexyloxy radical, n-nonyloxy radical, an n-decyloxy radical, n-dodecyloxy radical, n-tetradecyl oxy-radical, and n-hexadecyl oxy-radical, can be mentioned.
[0019] As an example of a compound expressed with the general formula (1) concerning this invention, although the following compounds (** 4 —izing 16) can be mentioned, this invention is not limited to these, for example. In addition, Ph expresses a phenyl group among a formula and Bz expresses benzyl.
[0020]
[Formula 4]

例示化合物番号

1



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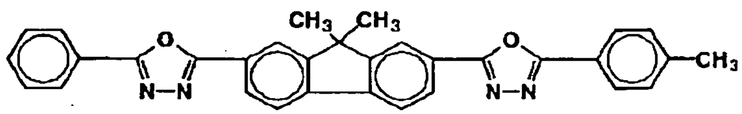

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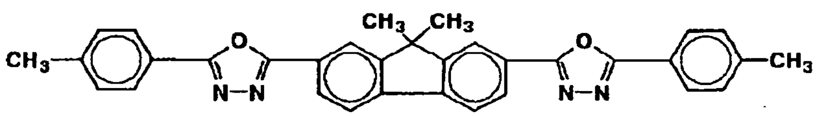

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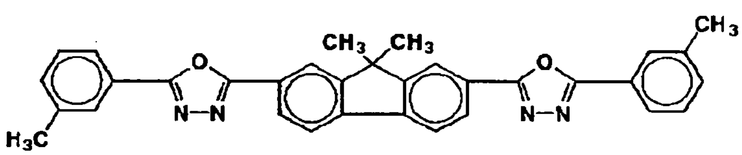

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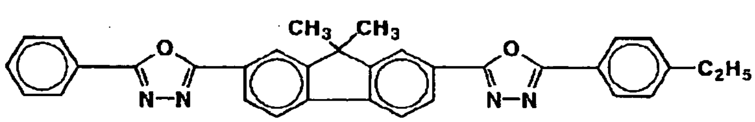
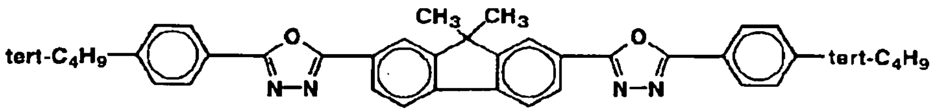
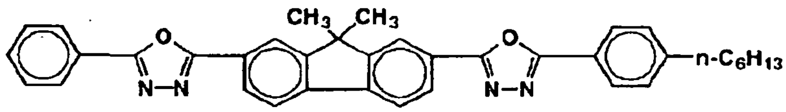
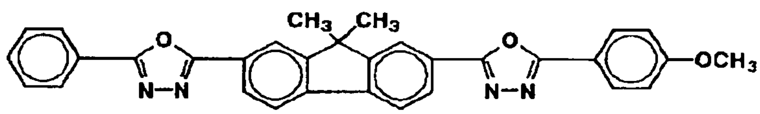
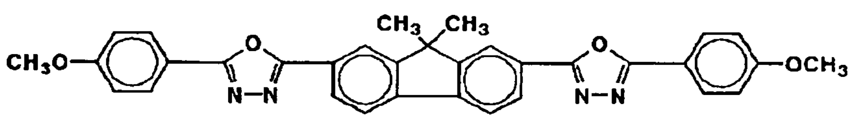


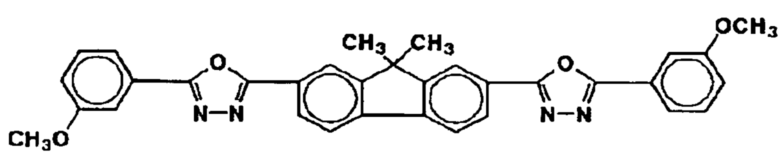
[0021]
[Formula 5]

6 

7 

8 

9 

10 

[0022]
[Formula 6]

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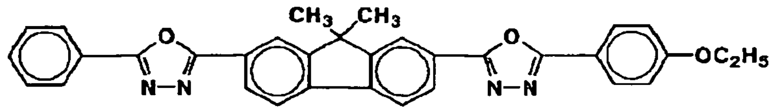

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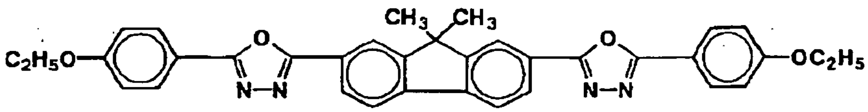

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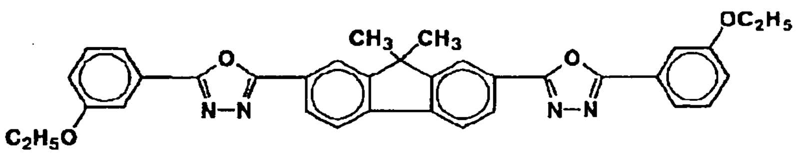

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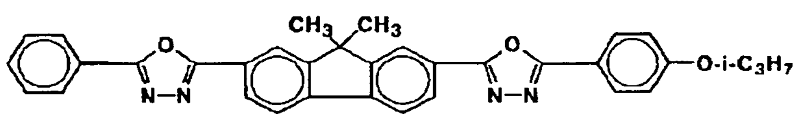

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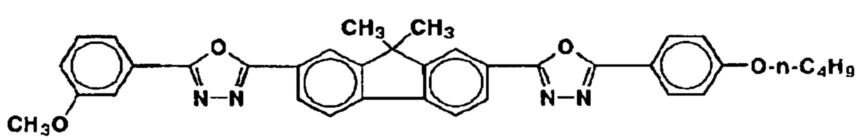

[0023]
[Formula 7]

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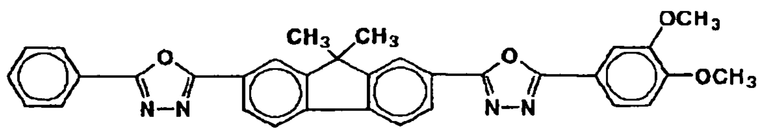

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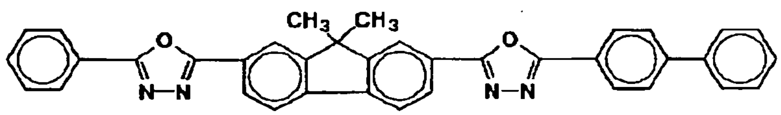

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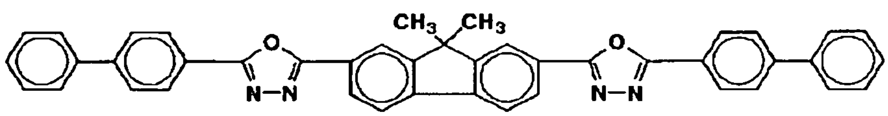

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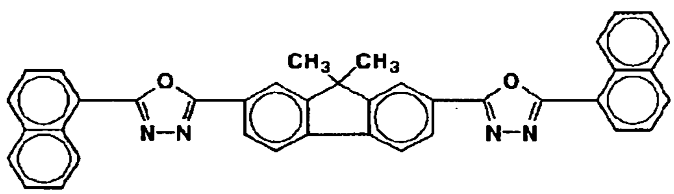

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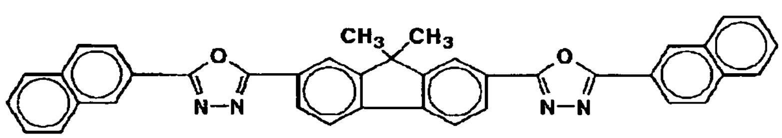
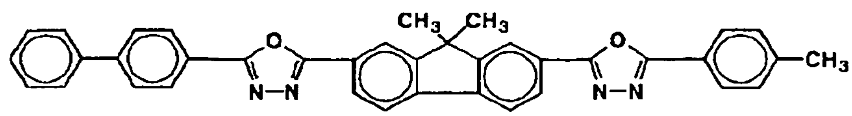
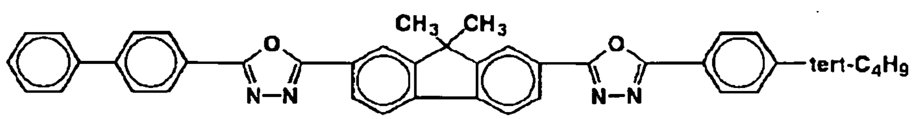
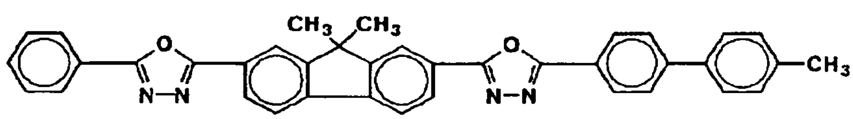
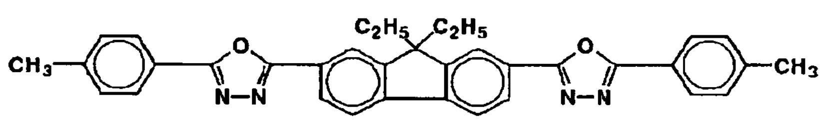


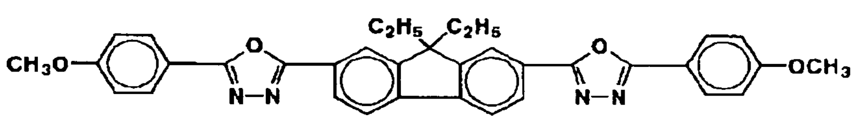
[0024]
[Formula 8]

21 

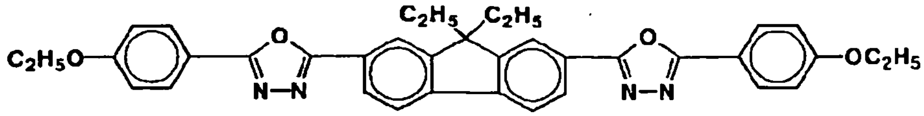
22 

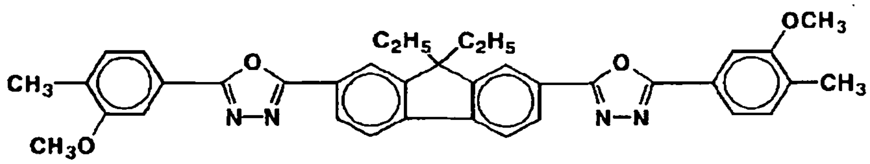
23 

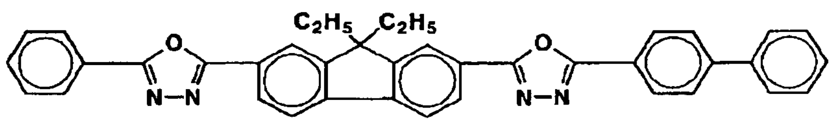
24 

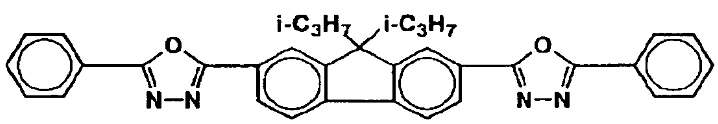
25 

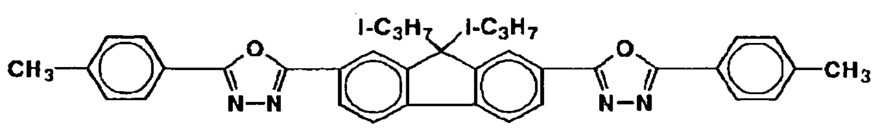
[0025]
[Formula 9]

26 

27 

28 

29 

30 

[0026]
[Formula 10]

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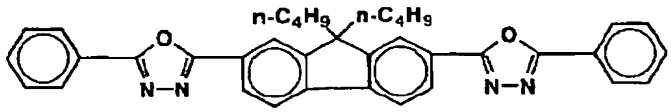

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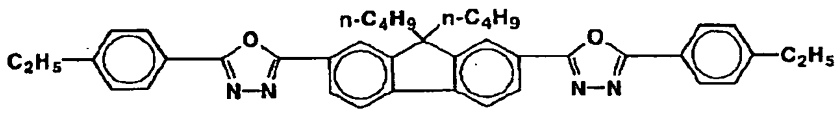

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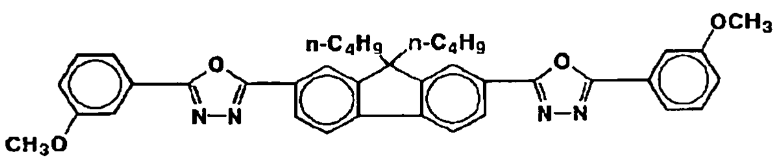

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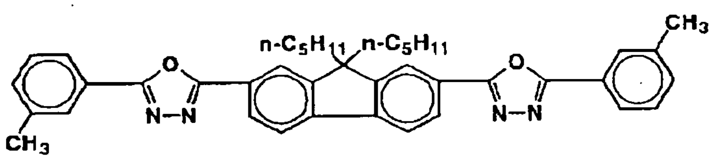

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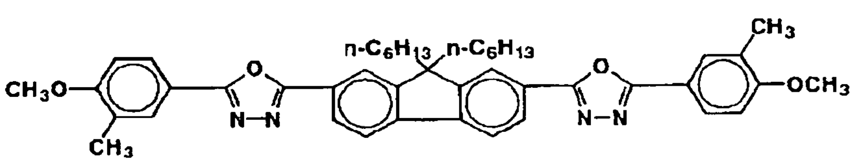

[0027]
[Formula 11]

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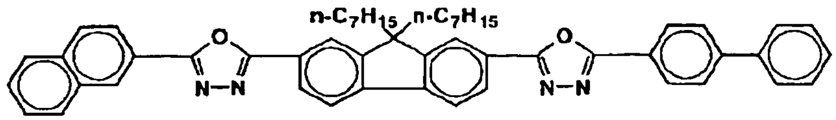

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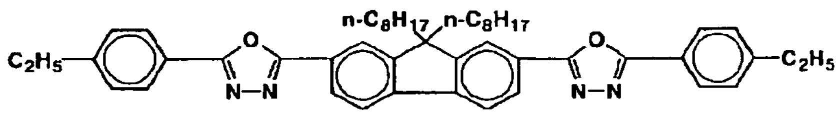

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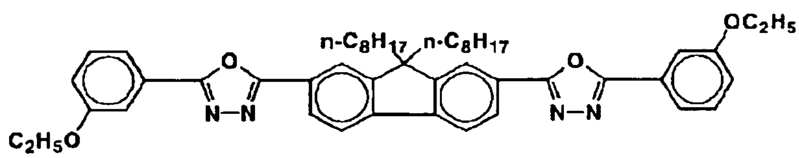

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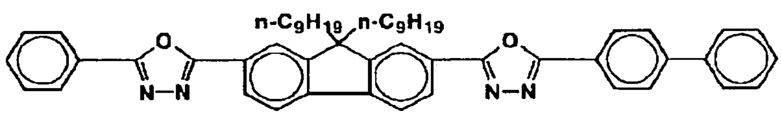

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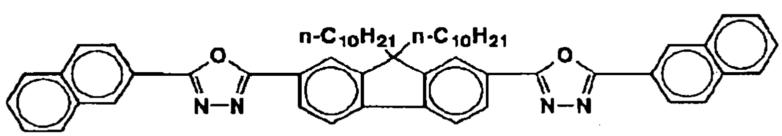
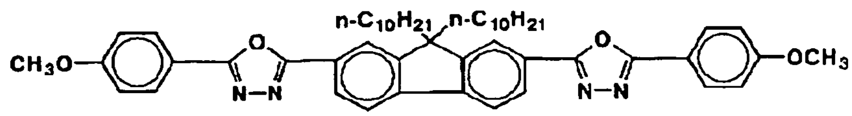
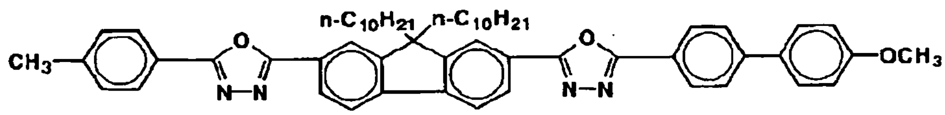
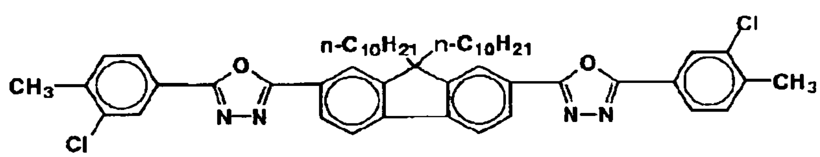
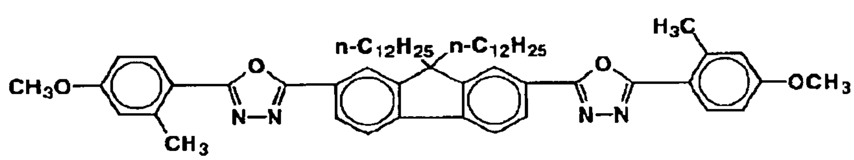


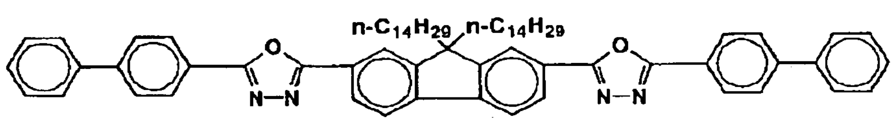
[0028]
[Formula 12]

41 

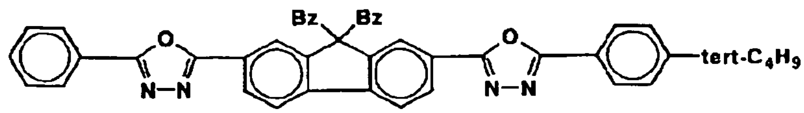
42 

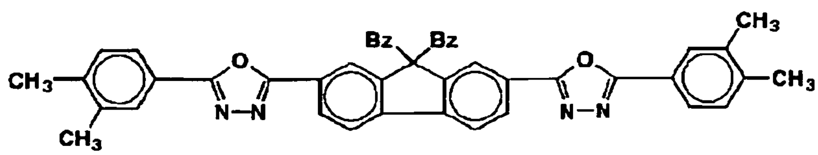
43 

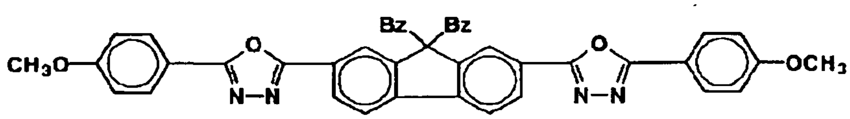
44 

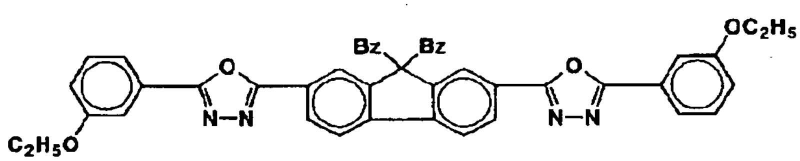
45 

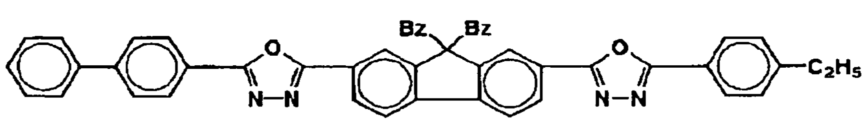
[0029]
[Formula 13]

46 

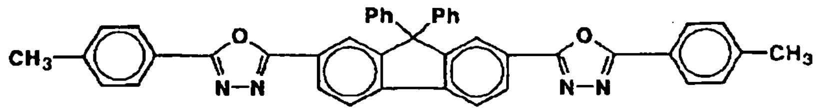
47 

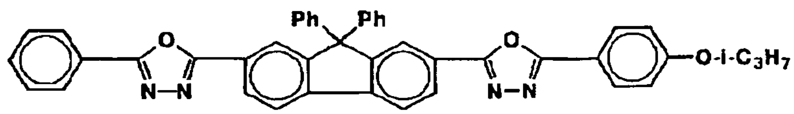
48 

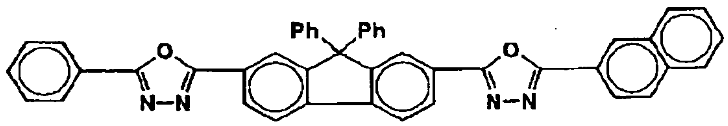
49 

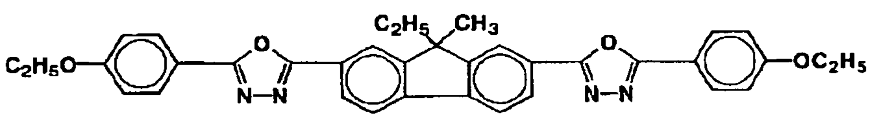
50 

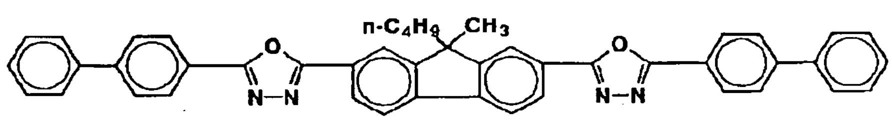
[0030]
[Formula 14]

51 

52 

53 

54 

55 

[0031]
[Formula 15]

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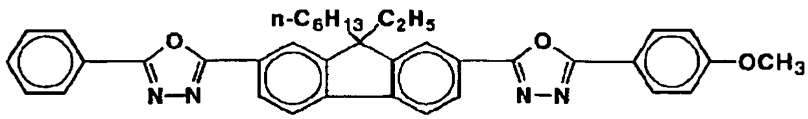

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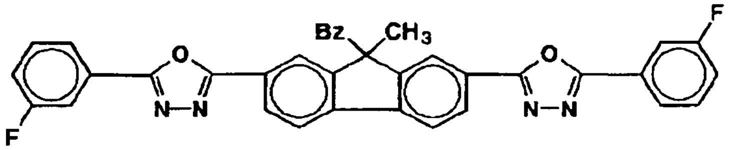

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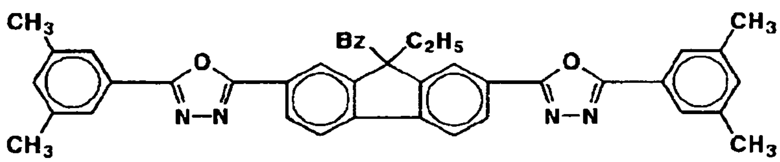

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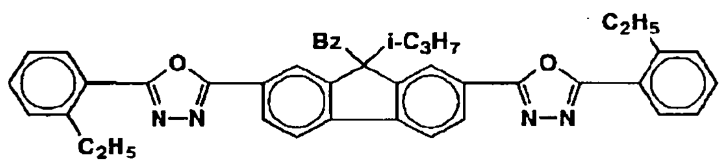

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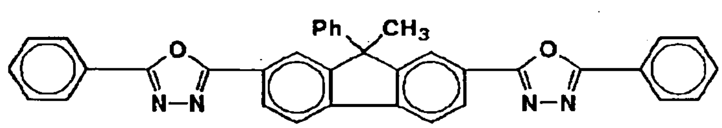
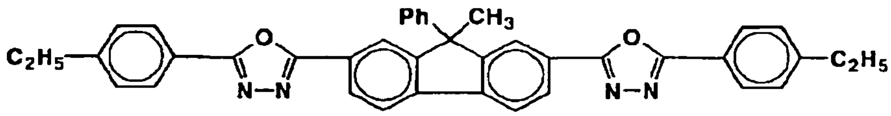
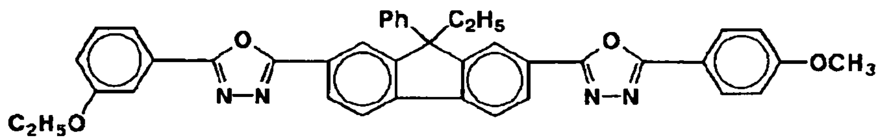
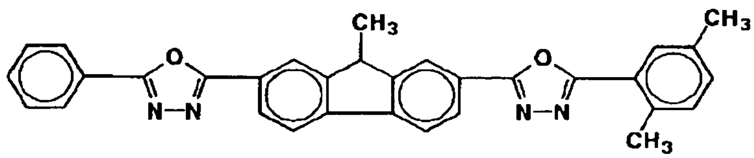
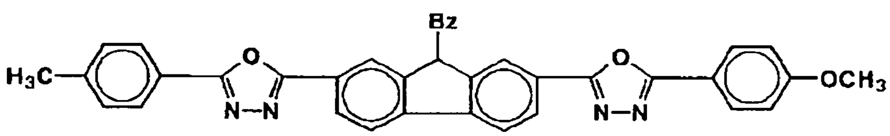


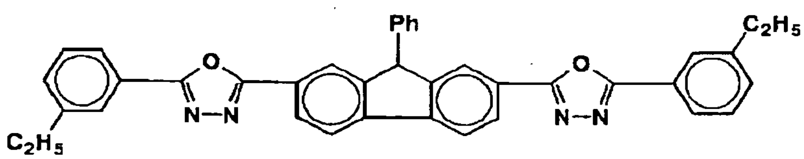
[0032]
[Formula 16]

61 

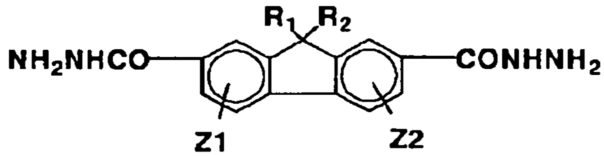
62 

63 

64 

65 

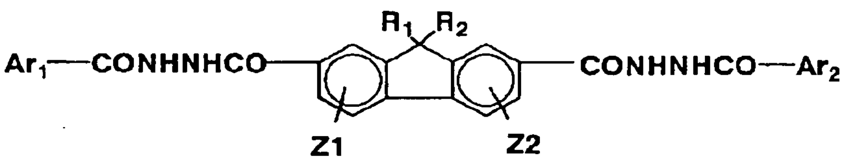
[0033] The compound expressed with the general formula (1) concerning this invention can be itself manufactured by the well-known approach. Namely, for example, a fluorene -2,.7-dicarboxylic acid derivative The compound expressed with the general formula (2) which can be manufactured from for example, (a fluorene -2, 7-dicarboxylic acid halide derivative, a fluorene -2 and 7-dicarboxylic acid ester derivative), and a hydrazine, and (** 17), The compound expressed with a general formula (3) and (** 17) and the compound expressed with a general formula (4) and (** 17) are made to react, and after manufacturing the compound expressed with a general formula (5) and (** 17), it can manufacture by making a dehydrating agent (for example, phosphorus oxychloride) act.
[0034]
[Formula 17]



(2)

Ar_1—COY_1 (3)

Y_2OC—Ar_2 (4)



(5)

[Among a formula, Y1 and Y2 express a halogen atom, and Ar1, Ar2, R1, R2, Z1, and Z2 express the same semantics as a general formula (1).]

[0035] Organic electroluminescence devices usually come at least to pinch the luminous layer which contains at least one sort of luminescence components in inter-electrode [of a pair] further. In consideration of each functional level of the hole injection of the compound used for a luminous layer and electron hole transportation, electron injection, and electronic transportation, the electron injection transportation layer containing the hole-injection transportation layer and/or electron injection transportation component containing a hole-injection transportation component can also be prepared according to a request. For example, when the hole-injection function of the compound used for a luminous layer, an electron hole transportation function and/or an electron injection function, and an electronic transportation function are good, a luminous layer can consider as the configuration of the component of the mold which served both as the hole-injection transportation layer and/or the electron injection transportation layer. Of course, it can also consider as the configuration of the component (much more component of a mold) of the mold which does not prepare the layer of both a hole-injection transportation layer and an electron injection transportation layer depending on the case. Moreover, a hole-injection transportation layer, an electron injection transportation layer, and each layer of a luminous layer may be structures much more, or may be multilayer structure, in each layer, the layer which has an impregnation function, and the layer which has a transportation function can be prepared separately, and a hole-injection transportation layer and an electron injection transportation layer can also constitute it.

[0036] In the organic electroluminescence devices of this invention, as for the compound expressed with a general formula (1), it is desirable to use for a hole-injection transportation component, a luminescence component, or an electron injection transportation component, and it is more desirable to use for a luminescence component or an electron injection transportation component. In the organic electroluminescence devices of this invention, the compound expressed with a general formula (1) may be used independently, or may be used together. [two or more]

[0037] Especially as a configuration of the organic electroluminescence devices of this invention, it cannot limit and (C) anode plate / luminous layer / electron injection transportation layer / cathode mold component (drawing 3), (D) anode plate / luminous layer / cathode mold component (drawing 4), etc. can be mentioned (drawing 2). (drawing 1) Furthermore, it can also consider as (E) anode plate / hole-injection transportation layer / electron injection transportation layer / luminous layer / electron injection transportation layer / cathode mold component (drawing 5) which is a component of the mold which put the luminous layer in the electron injection transportation layer. (D) Although the component of the mold which made inter-electrode [of a pair] pinch a luminescence component with a gestalt further is included as a component configuration of a mold The component of the mold which it made inter-electrode [of a pair] pinch more preferably with the one-layer gestalt which mixed (F) hole-injection transportation component, the luminescence component, and the electron injection transportation component (drawing 6), (G) It is the component (drawing 8 R> 8) of the mold which it made inter-electrode [of a pair] pinch with the one-layer gestalt which mixed the component (drawing 7) or (H) luminescence component, and the electron injection transportation component of the mold which it made inter-electrode [of a pair] pinch with the one-layer gestalt which mixed the hole-injection transportation component and the luminescence

component.
[0038] The organic electroluminescence devices of this invention cannot be restricted to these component configurations, and can prepare a hole-injection transportation layer, a luminous layer, and a two or more layers electron injection transportation layer in each type of component. Moreover, in each type of component, the mixolimnion of a luminescence component and an electron injection transportation component can also be prepared between a hole-injection transportation layer and a luminous layer between the mixolimnion of a hole-injection transportation component and a luminescence component and/or a luminous layer, and an electron injection transportation layer. The configuration of more desirable organic electroluminescence devices is (A) mold component, (B) mold component, (C) mold component, (E) mold component, (F) mold component, (G) mold component, or (H) mold component, and is (A) mold component, (B) mold component, (C) mold component, or (F) mold component still more preferably.
[0039] As organic electroluminescence devices of this invention, (A) anode plate / hole-injection transportation layer / luminous layer / electron injection transportation layer / cathode mold component shown in (drawing 1) are explained, for example. (drawing 1) -- setting -- 1 -- a substrate and 2 -- in an anode plate and 3, an electron injection transportation layer and 6 show cathode, and, as for a hole-injection transportation layer and 4, 7 shows a power source, as for a luminous layer and 5.
[0040] Being supported by the substrate 1 is desirable, especially as a substrate, although the organic electroluminescence devices of this invention are not limited, transparence thru/or a translucent thing are desirable [electroluminescence devices], for example, they can mention what consists of a compound sheet which combined a glass plate, a transparence sheet plastic (for example, sheets, such as polyester, a polycarbonate, polysulfone, polymethylmethacrylate, polypropylene, and polyethylene), a translucent sheet plastic, a quartz, transparent ceramics, or these. Furthermore, the luminescent color is also controllable to a substrate combining for example, the color filter film, the color conversion film, and the dielectric reflective film.
[0041] As an anode plate 2, it is desirable to use a metal with a comparatively large work function, an alloy, or an electric conductivity compound as electrode material. As electrode material used for an anode plate, gold, platinum, silver, copper, cobalt, nickel, palladium, vanadium, a tungsten, tin oxide, a zinc oxide, ITO (indium Tin oxide), the poly thiophene, polypyrrole, etc. can be mentioned, for example. Such electrode material may be used independently or may be used together. [two or more] An anode plate can form such electrode material on a substrate by approaches, such as vacuum deposition and the sputtering method. Moreover, an anode plate may be structure much more, or may be multilayer structure. The sheet electric resistance of an anode plate is more preferably set as 5-50ohms / ** extent below hundreds of ohms / **. Although the thickness of an anode plate is based also on the ingredient of the electrode material to be used, generally it is more preferably set as about 10-500nm about 5-1000nm.
[0042] The hole-injection transportation layer 3 is a layer containing the compound which has the function to convey the electron hole which makes easy impregnation of the electron hole (hole) from an anode plate, and which was functioned and poured in. A hole-injection transportation layer can be formed using the compounds (for example, a phthalocyanine derivative, a thoria reel methane derivative, a thoria reel amine derivative, an oxazole derivative, a hydrazone derivative, a stilbene derivative, a pyrazoline derivative, a polysilane derivative, polyphenylene vinylene and its derivative, the poly thiophene and its derivative, a Polly N-vinylcarbazole derivative, etc.) which have the compound and/or other hole-injection transportation functions in which it is expressed with a general formula (1) at least one sort. In addition, the compound which has a hole-injection transportation function may be used independently, or may be used together. [two or more]
[0043] As a compound which has other hole-injection transportation functions to use in this invention a thoria reel amine derivative (for example, 4 and 4' screw [-] [N-phenyl-N-(4″-methylphenyl) amino] biphenyl --) 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl, 4 and 4' screw [-] [N-phenyl-N-(3″-methoxypheny) amino] biphenyl, 4 and 4' screw [-] [N-phenyl-N-(1″-naphthyl) amino] biphenyl, 3 and 3' -- the - dimethyl -4 and 4' - screw [N-phenyl-N-(3″-methylphenyl) amino] biphenyl -- 1 and 1-screw [4'-[N and N-JI (4″-methylphenyl) amino] phenyl] cyclohexane, 9, 10-screw [N-(4'-methylphenyl)-N-(4″-n-buthylphenyl) amino] phenanthrene, 3, 8-screw (N and N-diphenylamino)-6-phenyl phenanthridine, four - methyl - N -- N - a screw -- [-- four -- ″ -- four -- ″ -- ' - a screw -- [-- N -- ' -- N -- ' - JI (4-methylphenyl) -- amino --] -- a biphenyl - four - IRU --] -- an aniline -- N, N'-screw [4-(diphenylamino) phenyl]-N, N'-diphenyl -1, 3-diaminobenzene, N, N'-screw [4-(diphenylamino) phenyl]-N, N'-diphenyl -1, 4-diaminobenzene, 5 and 5 ″- screw [4-(screw [4-methylphenyl] amino) phenyl]-2, 2':5', 2″-TACHIOFEN, 1, 3, 5-tris (diphenylamino) benzene, 4, 4', a 4″-tris (N-carbazoyl) triphenylamine, 4, 4', a 4″-tris [N-(3‴-methylphenyl)-N-phenylamino] triphenylamine, The poly thiophene and its derivatives, such as 1, 3, and 5-tris [N-(4'-diphenyl aminophenyl) phenylamino] benzene, and a Polly N-vinylcarbazole derivative are more desirable. When using together the compound expressed with a general formula (1), and the compound which has other hole-injection transportation functions, the rate of a compound of being expressed with the general formula (1) occupied in a hole-injection transportation layer is preferably prepared to about 0.1 - 40% of the weight.
[0044] A luminous layer 4 is a layer containing the compound which has an electron hole and electronic impregnation functions, those transportation functions, and the function to make the recombination of an electron hole and an electron generate an exciton. the compound (for example, an acridone derivative, the Quinacridone derivative, and a polynuclear aromatic compound -- [-- for example) which has the compound and/or other luminescence functions in which a luminous layer is expressed with a general formula (1) Rubrene, an anthracene, tetracene, a pyrene, perylene, a chrysene, Deca cyclene, coronene, a tetra-phenyl cyclopentadiene, a PENTA phenyl

cyclopentadiene, 9, 10-diphenyl anthracene, 9, 10-screw (phenyl ethynyl) anthracene, 1, 4-screw (9'-ethynyl anthracenyl) benzene, 4, and 4'-screw (9''-ethynyl anthracenyl) biphenyl] and a thoria reel amine derivative — [— for example] which can mention the compound mentioned above as a compound which has a hole-injection transportation function, and an organometallic complex — [— for example Tris (8-quinolate) aluminum, screw (10-benzo[h] quinolate) beryllium, The zinc salt of 2-(2'-hydroxyphenyl) benzooxazole, the zinc salt of 2-(2'-hydroxyphenyl) benzothiazole, the zinc salt of a 4-hydroxy acridine, the zinc salt of a 3-hydroxy flavone, the beryllium salt of a 5-hydroxy flavone, aluminum salt [of a 5-hydroxy flavone]], and a stilbene derivative — [— for example 1, 1, 4, and 4-tetra-phenyl-1,3-butadiene, 4, and 4'-screw (2 and 2-diphenyl vinyl) biphenyl] and a coumarin derivative — [— for example A coumarin 1, a coumarin 6, a coumarin 7, a coumarin 30, a coumarin 106, a coumarin 138, a coumarin 151, a coumarin 152, a coumarin 153, a coumarin 307, a coumarin 311, a coumarin 314, a coumarin 334, a coumarin 338, a coumarin 343, coumarin 500], a pyran derivative ([DCM1, DCM2]), and oxazone derivative — [— for example, [for example,] Nile red], a benzothiazole derivative, a benzooxazole derivative, A benzimidazole derivative, a pyrazine derivative, a cinnamate derivative, Polly N-vinylcarbazole and its derivative, the poly thiophene, and its derivative, Polyphenylene and its derivative, the poly fluorene, and its derivative, Polyphenylene vinylene and its derivative, poly biphenylene vinylene, and its derivative, At least one sort can be formed using poly terphenylene vinylene and its derivative, poly naphthylene vinylene and its derivative, poly thienylene vinylene, its derivative, etc.

[0045] In the organic electroluminescence devices of this invention, it is desirable to contain the compound expressed with a general formula (1) to a luminous layer. When using together the compound expressed with a general formula (1) to a luminous layer, and the compound which has other luminescence functions, the rate of a compound of being expressed with a general formula (1) to the luminous layer occupied in a luminous layer is more preferably prepared to about 0.1 - 99.9% of the weight still more preferably about 0.01 to 99.99% of the weight about 0.001 to 99.999% of the weight.

[0046] As a compound which has other luminescence functions to use in this invention, a luminescent organometallic complex is more desirable. For example, a luminous layer can also consist of a host compound and a guest compound (dopant) like a publication in J.Appl.Phys., 65, 3610 (1989), and JP,5-214332,A. A luminous layer can be formed using the compound expressed with a general formula (1) as a host compound, further, it can use as a guest compound and a luminous layer can also be formed. When forming a luminous layer, using the compound expressed with a general formula (1) as a guest compound, as a host compound, a luminescent organometallic complex is desirable. In this case, to a luminescent organometallic complex, the compound expressed with a general formula (1) is twisted, and is used especially about 0.1 to 10% of the weight about 0.01 to 30% of the weight about 0.001 to 40% of the weight preferably.

[0047] Especially as a luminescent organometallic complex used together with the compound expressed with a general formula (1), although it does not limit, a luminescent organic aluminum complex is desirable and the luminescent organic aluminum complex which has 8-quinolate ligand which is not permuted [a permutation or] is more desirable. As a luminescent desirable organometallic complex, the luminescent organic aluminum complex expressed with a general formula (a) - a general formula (c) can be mentioned, for example.

(Q)3 -Al (a)

(Q expresses among a formula 8-quinolate ligand which is not permuted [a permutation or])

(Q)2 -Al-O-L (b)

(Q expresses a permutation 8-quinolate ligand among a formula, O-L is a phenolate ligand and L expresses the hydrocarbon group of the carbon numbers 6-24 containing a phenyl part)

(Q)2 -Al-O-Al-(Q)2 (c)

(Q expresses a permutation 8-quinolate ligand among a formula)

[0048] As an example of a luminescent organometallic complex, for example Tris (8-quinolate) aluminum, Tris (4-methyl-8-quinolate) aluminum, tris (5-methyl-8-quinolate) aluminum, Tris (3, 4-dimethyl-8-quinolate) aluminum, tris (4, 5-dimethyl-8-quinolate) aluminum, Tris (4, 6-dimethyl-8-quinolate) aluminum, screw (2-methyl-8-quinolate) (phenolate) aluminum, Screw (2-methyl-8-quinolate) (2-methyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3-methyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (4-methyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2-phenyl phenolate) aluminum, screw (2-methyl-8-quinolate) (3-phenyl phenolate) aluminum, [0049] Screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 3-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 6-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3, 4-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3, 5-dimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (3, 5-G tert-butyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 6-diphenyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 4, 6-triphenyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 4, 6-trimethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (2, 4, 5, 6-tetramethyl phenolate) aluminum, Screw (2-methyl-8-quinolate) (1-naphth RATO) aluminum, Screw (2-methyl-8-quinolate) (2-naphth RATO) aluminum, Screw (2, 4-dimethyl-8-quinolate) (2-phenyl phenolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) (3-phenyl phenolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) (4-phenyl phenolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) (3, 5-dimethyl phenolate) aluminum, screw (2, 4-dimethyl-8-quinolate) (3, 5-G tert-butyl phenolate) aluminum, [0050] Screw (2-methyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-8-quinolate) aluminum, Screw (2, 4-dimethyl-8-quinolate) aluminum-mu-oxo--screw (2, 4-dimethyl-8-quinolate) aluminum, Screw (2-methyl-4-ethyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-4-ethyl-8-quinolate) aluminum, Screw (2-methyl-4-methoxy-8-quinolate) aluminum-mu-oxo--screw (2-methyl-4-methoxy-8-quinolate) aluminum, Screw

(2-methyl-5-cyano-8-quinolate) aluminum-mu-oxo--screw (2-methyl-5-cyano-8-quinolate) aluminum, Screw (2-methyl-5-trifluoromethyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-5-trifluoromethyl-8-quinolate) aluminum etc. can be mentioned. Of course, a luminescent organometallic complex may be used independently or may be used together. [two or more]

[0051] The electron injection transportation layer 5 is a layer containing the compound which has the function to convey the electron which makes impregnation of the electron from cathode easy, and which was functioned and poured in. the compound (for example, an organometallic complex -- [-- for example) which has the compound and/or other electron injection transportation functions in which an electron injection transportation layer is expressed with a general formula (1) Tris (8-quinolate) aluminum and screw (10-benzo[h] quinolate) beryllium], An OKISA diazole derivative, a triazole derivative, a triazine derivative, a perylene derivative, a quinoline derivative, a quinoxaline derivative, a diphenyl quinone derivative, and nitration full -- me -- non, at least one sort can be formed using a derivative, a thiopyran dioxide derivative, etc. In the organic electroluminescence devices of this invention, it is desirable to contain the compound expressed with an electron injection transportation layer by the general formula (1). When using together the compound expressed with a general formula (1), and the compound which has other electron injection transportation functions, the rate of a compound of being expressed with the general formula (1) occupied in an electron injection transportation layer is especially prepared to about 0.5 - 20% of the weight preferably about 0.2 to 30% of the weight still more preferably about 0.1 to 40% of the weight more preferably 0.1% of the weight or more. In this invention, it is desirable to use together the compound and organometallic complex [for example, the compound expressed with said general formula (a) - a general formula (c)] which are expressed with a general formula (1), and to form an electron injection transportation layer.

[0052] As cathode 6, it is desirable to use a metal with a comparatively small work function, an alloy, or an electric conductivity compound as electrode material. As electrode material used for cathode, a lithium and lithium-indium alloy, sodium, and sodium-potassium alloy, calcium, magnesium, and magnesium-silver alloy, a magnesium-indium alloy, an indium, a ruthenium, titanium, manganese, an yttrium, aluminum, an aluminium-lithium alloy, an aluminum-calcium alloy, an aluminum magnesium alloy, a graphite thin film, etc. can be mentioned, for example. Such electrode material may be used independently or may be used together. [two or more]

[0053] Cathode can form such electrode material on an electron injection transportation layer by approaches, such as vacuum deposition, the sputtering method, ionization vacuum deposition, the ion plating method, and the ionized cluster beam method. Moreover, cathode may be structure much more or may be multilayer structure. In addition, as for the sheet electric resistance of cathode, it is desirable to set to below hundreds of ohms / **. Although the thickness of cathode is based also on the ingredient of the electrode material to be used, generally it is more preferably set as about 10-500nm about 5-1000nm. In addition, in order to take out luminescence of organic electroluminescence devices efficiently, it is desirable to be transparence thru/or that one [at least] electrode of an anode plate or cathode is translucent, and it is more desirable to set up the ingredient of an anode plate and thickness generally, so that the permeability of luminescence light may become 70% or more.

[0054] moreover, the organic electroluminescence devices of this invention -- setting -- the -- the singlet oxygen quencher may contain in inside further at least. Especially as a singlet oxygen quencher, it does not limit, and rubrene, a nickel complex, diphenyl iso benzofuran, etc. are mentioned, for example, it is rubrene especially preferably. Especially as a layer which the singlet oxygen quencher contains, although it does not limit, it is a luminous layer or a hole-injection transportation layer, and is a hole-injection transportation layer more preferably. In addition, for example, when making a hole-injection transportation layer contain a singlet oxygen quencher, homogeneity may be made to contain in a hole-injection transportation layer, and you may make it contain near a hole-injection transportation layer and the adjoining layer (for example, a luminous layer, the electron injection transportation layer which has a luminescence function). 0.01- of the amount of whole which constitutes the layer (for example, hole-injection transportation layer) to contain as a content of a singlet oxygen quencher -- it is 0.1 - 20 % of the weight more preferably 0.05 to 30% of the weight 50% of the weight.

[0055] Especially concerning the formation approach of a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, it cannot limit and can produce by forming a thin film by vacuum evaporation technique, ionization vacuum deposition, and the solution applying methods (for example, a spin coat method, the cast method, a dip coating method, the bar coat method, the roll coat method, a Langmuir-Blodgett method, etc.) for example. Although especially the conditions of vacuum deposition are not limited when forming each class with a vacuum deposition method, it is 0.005 - 50 nm/sec under the vacuum below 10-5Torr extent at the boat temperature (source temperature of vacuum evaporationo) of about 50-400 degrees C, and the substrate temperature of about -50-300 degrees C. It is desirable to carry out with the evaporation rate of extent. In this case, each class, such as a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, can manufacture the organic electroluminescence devices which were further excellent in many properties by forming continuously under a vacuum. When forming each class, such as a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, with a vacuum deposition method using two or more compounds, it is desirable that carry out temperature control of each boat into which the compound was put, and it carries out vapor codeposition according to an individual.

[0056] By the solution applying method, when you form each class, a solvent is dissolved or distributed and let the component which forms each class, its component, binder resin, etc. be coating liquid. As binder resin which can be used for each class of a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer For example, Polly N-vinylcarbazole, polyarylate, polystyrene, Polyester, a polysiloxane,

polymethyl acrylate, polymethylmethacrylate, A polyether, a polycarbonate, a polyamide, polyimide, polyamidoimide, Poly paraxylene, polyethylene, polyphenylene oxide, polyether sulfone, High molecular compounds, such as the poly aniline and its derivative, the poly thiophene and its derivative, polyphenylene vinylene and its derivative, the poly fluorene and its derivative, poly thienylene vinylene, and its derivative, are mentioned. Binder resin may be used independently or may be used together. [two or more]

[0057] When forming each class by the solution applying method, the component which forms each class, its component, binder resin, etc. a suitable organic solvent (for example, a hexane, an octane, Deccan, and toluene --) Hydrocarbon system solvents, such as a xylene, ethylbenzene, and 1-methylnaphthalene, For example, an acetone, a methyl ethyl ketone, methyl isobutyl ketone, Ketone solvent, for example, dichloromethane, such as a cyclohexanone, chloroform, Tetrachloromethane, a dichloroethane, trichloroethane, tetrachloroethane, Halogenated hydrocarbon system solvents, such as a chlorobenzene, a dichlorobenzene, and chloro toluene, For example, ester solvent, such as ethyl acetate, butyl acetate, and amyl acetate, For example, a methanol, propanol, a butanol, a pentanol, a hexanol, Alcoholic solvent, such as a cyclohexanol, methyl cellosolve, ethylcellosolve, and ethylene glycol, For example, ether system solvents, such as dibutyl ether, a tetrahydrofuran, dioxane, and an anisole, For example, N.N-dimethylformamide, N,N-dimethylacetamide, A polar solvent and/or water, such as a 1-methyl-2-pyrrolidone, 1,3-dimethyl-2-imidazolidinone, and dimethyl sulfoxide, can be dissolved or distributed, it can consider as coating liquid, and a thin film can be formed by various kinds of applying methods.

[0058] In addition, especially as an approach of distributing, although it does not limit, it can distribute in the shape of a particle using a ball mill, a sand mill, a paint shaker, attritor, a homogenizer, etc., for example. It cannot limit, can be set as the density range suitable for producing desired thickness by the applying method to enforce, especially concerning the concentration of coating liquid, and, generally is about 1 - 30% of the weight of solution concentration preferably about 0.1 to 50% of the weight. In addition, although it does not limit especially concerning the amount used when using binder resin, generally it sets up to about 15 - 90% of the weight more preferably about 10 to 99% of the weight about 5 to 99.9% of the weight to the component which forms each class (receiving the total amount of each component, in forming the component of a mold further).

[0059] Although it does not limit especially concerning the thickness of a hole-injection transportation layer, a luminous layer, and an electron injection transportation layer, generally it is desirable to set it as 5nm - about 5 micrometers. In addition, to the produced component, a protective layer (closure layer) can be prepared, and a component can be enclosed into inactive substances, such as paraffin, a liquid paraffin, a silicone oil, a fluorocarbon oil, and a zeolite content fluorocarbon oil, and can be protected in order to prevent contact with oxygen, moisture, etc. As an ingredient used for a protective layer, for example Organic polymeric materials for example, fluorination resin, an epoxy resin, silicone resin, and epoxy silicone resin -- Polystyrene, polyester, a polycarbonate, a polyamide, polyimide, Polyamidoimide, poly paraxylene, polyethylene, polyphenylene oxide, an inorganic material (for example, diamond thin film, amorphous silica, and electric insulation glass --) A metallic oxide, a metal nitride, a metal carbonization object, metallic sulfide, and the ingredient that can mention a photo-setting resin etc. further and is used for a protective layer may be used independently, or may be used together. [two or more] A protective layer may be structure much more, and may be multilayer structure.

[0060] Moreover, for example, a metal oxide film (for example, aluminum-oxide film) and the metal fluoride film can also be prepared in an electrode as a protective coat. Moreover, for example, the volume phase (interlayer) which consists of an organic phosphorous compound, polysilane, an aromatic amine derivative, and a phthalocyanine derivative can also be prepared on the surface of an anode plate. Furthermore, an electrode, for example, an anode plate, can also process and use the front face with an acid, ammonia/hydrogen peroxide, or the plasma.

[0061] Generally, the organic electroluminescence devices of this invention can be used also as a component of a pulse drive mold or an alternating current drive mold, although used as a component of a direct-current drive mold. In addition, generally applied voltage is about 2-30V. The organic electroluminescence devices of this invention can be used for for example, the panel mold light source, various kinds of light emitting devices, various kinds of display devices, various kinds of indicators, various kinds of sensors, etc.

[Translation done.]

EXAMPLE

[Example] Hereafter, although an example explains this invention to a detail further, of course, this invention is not limited to these.
The glass substrate which has an ITO transparent electrode (anode plate) with an example 1 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum and the instantiation compound number 1 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:0.5) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 55 mA/cm2. The current flowed. Brightness 2450 cd/m2 Luminescence of a bluish green color was checked.
[0063] In two to example 19 example 1, instead of using the compound of the instantiation compound number 1 on the occasion of formation of a luminous layer The compound (example 2) of the instantiation compound number 3, the compound of the instantiation compound number 5 (example 3), The compound (example 4) of the instantiation compound number 6, the compound of the instantiation compound number 9 (example 5), The compound (example 6) of the instantiation compound number 14, the compound of the instantiation compound number 17 (example 7), The compound (example 8) of the instantiation compound number 20, the compound of the instantiation compound number 22 (example 9), The compound (example 10) of the instantiation compound number 26, the compound of the instantiation compound number 30 (example 11), The compound (example 12) of the instantiation compound number 32, the compound of the instantiation compound number 35 (example 13), The compound (example 14) of the instantiation compound number 39, the compound of the instantiation compound number 47 (example 15), Organic electroluminescence devices were produced by the approach of a publication in the example 1 except having used the compound (example 16) of the instantiation compound number 51, the compound (example 17) of the instantiation compound number 54, the compound (example 18) of the instantiation compound number 58, and the compound (example 19) of the instantiation compound number 61. Blue luminescence was checked when the direct current voltage of 12V was impressed to each component under the desiccation ambient atmosphere. Furthermore the property was investigated and the result was shown in the 1st table (Table 1).
[0064] On the occasion of formation of a luminous layer, without using the compound of the instantiation compound number 1, only using screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum, it vapor-deposited in thickness of 50nm, and organic electroluminescence devices were produced by the approach of a publication in the example 1 in example of comparison 1 example 1 except having considered as the luminous layer. Blue luminescence was checked when the direct current voltage of 12V was impressed to this component under the desiccation ambient atmosphere. Furthermore the property was investigated and the result was shown in the 1st table (Table 1).
[0065] In example of comparison 2 example 1, organic electroluminescence devices were produced by the approach of a publication in the example 1 except having used N-methyl-2-methoxy acridone instead of using the compound of the instantiation compound number 1 on the occasion of formation of a luminous layer. Blue luminescence was checked when the direct current voltage of 12V was impressed to this component under the desiccation ambient atmosphere. Furthermore the property was investigated and the result was shown in the 1st table (Table 1).
[0066]
[Table 1]

第１表

有機電界発光素子	輝度 (ｃｄ／ｍ²)	電流密度 (ｍＡ／ｃｍ²)
実施例２	２４６０	５５
実施例３	２４３０	５２
実施例４	２５２０	５５
実施例５	２４６０	５６
実施例６	２５４０	５２
実施例７	２５１０	５３
実施例８	２３２０	５２
実施例９	２４８０	５４
実施例１０	２５２０	５２
実施例１１	２４４０	５６
実施例１２	２４３０	５４
実施例１３	２４７０	５１
実施例１４	２５６０	５３
実施例１５	２４３０	５４
実施例１６	２４６０	５５
実施例１７	２６３０	５２
実施例１８	２４２０	５３
実施例１９	２５６０	５６
比較例１	１１７０	８２
比較例２	１５５０	７４

[0067] The glass substrate which has an ITO transparent electrode (anode plate) with an example 20 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (2-phenyl phenolate) aluminum and the instantiation compound number 4 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:1.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 58 mA/cm2. The current flowed. Brightness 2450 cd/m2 Blue luminescence was checked.
[0068] The glass substrate which has an ITO transparent electrode (anode plate) with an example 21 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl to an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-8-quinolate) aluminum and the instantiation compound number 8 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:2.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of

200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 57 mA/cm2. The current flowed. Brightness 2480 cd/m2 Luminescence of a bluish green color was checked.

[0069] The glass substrate which has an ITO transparent electrode (anode plate) with an example 22 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2, 4-dimethyl-8-quinolate) aluminum-mu-oxo--screw (2, 4-dimethyl-8-quinolate) aluminum and the instantiation compound number 12 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:4.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Next, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 60 mA/cm2. The current flowed. Brightness 2460 cd/m2 Blue luminescence was checked.

[0070] The glass substrate which has an ITO transparent electrode (anode plate) with an example 23 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, they are 4, 4', and a 4″-tris [N-(3‴-methylphenyl)-N-phenylamino] triphenylamine on an ITO transparent electrode Evaporation rate 0.1 nm/sec It vapor-deposited in thickness of 30nm, and considered as the first hole-injection transportation layer. Subsequently, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 45nm, and considered as the second hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum and the instantiation compound number 25 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:1.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. Furthermore on it, it is tris (8-quinolate) aluminum Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 58 mA/cm2. The current flowed. Brightness 2840 cd/m2 Blue luminescence was checked.

[0071] The glass substrate which has an ITO transparent electrode (anode plate) with an example 24 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, they are 4, 4', and a 4″-tris [N-(3‴-methylphenyl)-N-phenylamino] triphenylamine on an ITO transparent electrode Evaporation rate 0.1 nm/sec It vapor-deposited in thickness of 30nm, and considered as the first hole-injection transportation layer. Subsequently, it is 4 and 4' screw [-] [N-phenyl-N-(3″-methylphenyl) amino] biphenyl on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 45nm, and considered as the second hole-injection transportation layer. Subsequently, the compound of the instantiation compound number 24 was vapor-deposited in thickness of 50nm by evaporation rate 0.2 nm/sec on it, and it considered as the luminous layer which served as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 52 mA/cm2. The current flowed. Brightness 1670 cd/m2 Blue luminescence was checked.

[0072] instead of using the compound of the instantiation compound number 24 in example of comparison 3 example 24 on the occasion of formation of the luminous layer which served as the electron injection transportation layer — 1 and 3-screw [5'-(p-N and N-dimethylamino phenyl)- 1, 3, and 4-OKISA diazole-2' -- organic electroluminescence devices were produced by the approach of a publication in the example 24 except having used - IRU] benzene. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 55 mA/cm2. The current flowed. Brightness 1180 cd/m2 Blue luminescence was checked.

[0073] The glass substrate which has an ITO transparent electrode (anode plate) with an example 25 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, they are 4, 4', and a 4''-tris [N-(3'''-methylphenyl)-N-phenylamino] triphenylamine on an ITO transparent electrode Evaporation rate 0.1 nm/sec It vapor-deposited in thickness of 30nm, and considered as the first hole-injection transportation layer. Subsequently, it is 4 and 4' screw [-] [N-phenyl-N-(3''-methylphenyl) amino] biphenyl on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 45nm, and considered as the second hole-injection transportation layer. Subsequently, it is a 1, 1, 4, and 4-tetra-phenyl butadiene on it Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the luminous layer. Subsequently, on it, the compound of the instantiation compound number 31 was vapor-deposited in thickness of 50nm by evaporation rate 0.2 nm/sec, and was used as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 52 mA/cm2. The current flowed. Brightness 1370 cd/m2 Blue luminescence was checked. After saving this component in ten days and under a desiccation ambient atmosphere, when the electrical potential difference was impressed under the same conditions, the same luminescence brightness was observed.
[0074] instead of using the compound of the instantiation compound number 31 on the occasion of formation of an electron injection transportation layer in example of comparison 4 example 25 -- 2'-(4''-phenyl phenyl)-5'-(p-tert-buthylphenyl)- organic electroluminescence devices were produced by the approach of a publication in the example 25 except having used 1, 3, and 4-OKISA diazole. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 55 mA/cm2. The current flowed. Brightness 980 cd/m2 Blue luminescence was checked. Luminescence was not observed when the electrical potential difference was impressed under the same conditions, after saving this component in two days and under a desiccation ambient atmosphere.
[0075] The glass substrate which has an ITO transparent electrode (anode plate) with an example 26 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. After drying the substrate using nitrogen gas, carrying out UV / ozone washing further and fixing to the substrate electrode holder of vacuum evaporationo equipment, the vacuum evaporationo tub was decompressed to 3x10-6Torr. First, it is 4 and 4' screw [-] [N-phenyl-N-(3''-methylphenyl) amino] biphenyl on an ITO transparent electrode Evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 75nm, and considered as the hole-injection transportation layer. Subsequently, a source of vacuum evaporationo which is different on it in the compound of screw (2-methyl-8-quinolate) (4-phenyl phenolate) aluminum and the instantiation compound number 10 to evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 100:1.0) was carried out to the thickness of 50nm, and it considered as the luminous layer. subsequently, a it top -- 1 and 3-screw [5'-(p-tert-buthylphenyl)- 1, 3, and 4-OKISA diazole-2' - IRU] benzene -- evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 50nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 14V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 48 mA/cm2. The current flowed. Brightness 1930 cd/m2 Blue luminescence was checked.
[0076] The glass substrate which has an ITO transparent electrode (anode plate) with an example 27 thickness of 200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. The substrate was dried using nitrogen gas and UV / ozone washing was carried out further. On an ITO transparent electrode, next, Polly N-vinylcarbazole (weight average molecular weight 150000), The compound of the instantiation compound number 33, a coumarin 6 "a [3-(2'-benzothiazolyl)-7-diethylamino coumarin]" (green luminescence component), And DCM1 "a [4-(dicyanomethylene)-2-methyl-6-(4'-dimethylaminostyryl)-4H-pyran]" (orange luminescence component) The luminous layer with a thickness of 400nm was formed with the dip coating method using the 3-% of the weight dichloroethane solution contained at a rate of the weight ratio 100:5:3:2, respectively. Next, after fixing to the substrate electrode holder of vacuum evaporationo equipment the glass substrate which has this luminous layer, the vacuum evaporationo tub was decompressed to 3x10-6Torr. furthermore, a luminous layer top -- 3-(4'-tert-buthylphenyl)-4-phenyl -- 5-(4''-biphenyl)- 1, 2, and 4-triazole -- evaporation rate 0.2 nm/sec after vapor-depositing in thickness of 20nm -- further -- a it top -- tris (8-quinolate) aluminum -- evaporation rate 0.2 nm/sec It vapor-deposited in thickness of 30nm, and considered as the electron injection transportation layer. Furthermore on it, they are magnesium and silver Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. In addition, vacuum evaporationo was carried out, with the reduced pressure condition of a vacuum evaporationo tub maintained. When the direct current voltage of 12V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 74 mA/cm2. The current flowed. Brightness 1370 cd/m2 White luminescence was checked.
[0077] The glass substrate which has an ITO transparent electrode (anode plate) with an example 28 thickness of

200nm was cleaned ultrasonically using neutral detergent, an acetone, and ethanol. The substrate was dried using nitrogen gas and UV / ozone washing was carried out further. On an ITO transparent electrode, next, a polycarbonate (weight average molecular weight 50000), 4 and 4' screw [-] [N-phenyl-N-(3''-methylphenyl) amino] biphenyl, The compound of screw (2-methyl-8-quinolate) aluminum-mu-oxo--screw (2-methyl-8-quinolate) aluminum and the instantiation compound number 45 The luminous layer with a thickness of 300nm was formed with the dip coating method using the 3-% of the weight dichloroethane solution contained at a rate of the weight ratio 100:40:60:1, respectively. Next, after fixing to the substrate electrode holder of vacuum evaporationo equipment the glass substrate which has this luminous layer, the vacuum evaporationo tub was decompressed to 3x10-6Torr. Furthermore, they are magnesium and silver on a luminous layer Evaporation rate 0.2 nm/sec Vapor codeposition (weight ratio 10:1) was carried out to the thickness of 200nm, it considered as cathode, and organic electroluminescence devices were produced. When the direct current voltage of 15V was impressed to the produced organic electroluminescence devices under the desiccation ambient atmosphere, it is 66 mA/cm2. The current flowed. Brightness 740 cd/m2 Blue luminescence was checked.

[Translation done.]

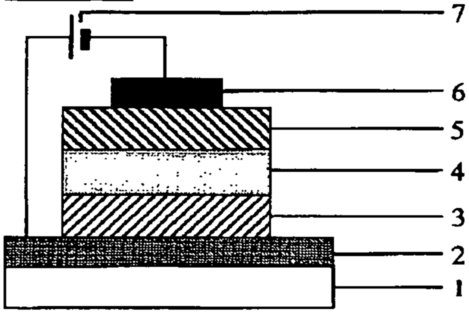
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is outline structural drawing of an example (A) of organic electroluminescence devices.
[Drawing 2] It is outline structural drawing of an example (B) of organic electroluminescence devices.
[Drawing 3] It is outline structural drawing of an example (C) of organic electroluminescence devices.
[Drawing 4] It is outline structural drawing of an example (D) of organic electroluminescence devices.
[Drawing 5] It is outline structural drawing of an example (E) of organic electroluminescence devices.
[Drawing 6] It is outline structural drawing of an example (F) of organic electroluminescence devices.
[Drawing 7] It is outline structural drawing of an example (G) of organic electroluminescence devices.
[Drawing 8] It is outline structural drawing of an example (H) of organic electroluminescence devices.
[Description of Notations]
1 Substrate
2 Anode Plate
3 Hole-Injection Transportation Layer
3a Hole-injection transportation component
4 Luminous Layer
4a Luminescence component
5 Electron Injection Transportation Layer
5″ Electron injection transportation layer
5a Electron injection transportation component
6 Cathode
7 Power Source

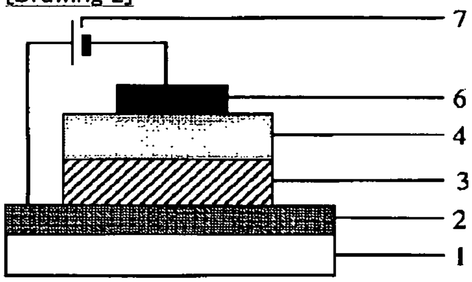
[Translation done.]

DRAWINGS

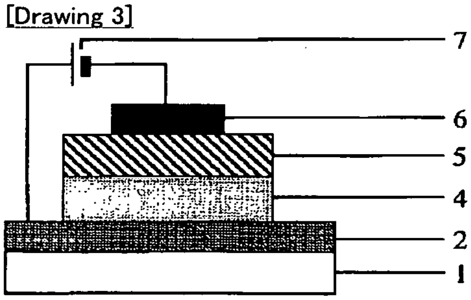
[Drawing 1]



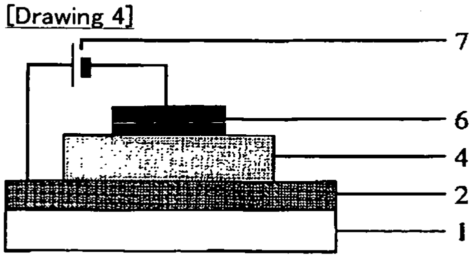
[Drawing 2]



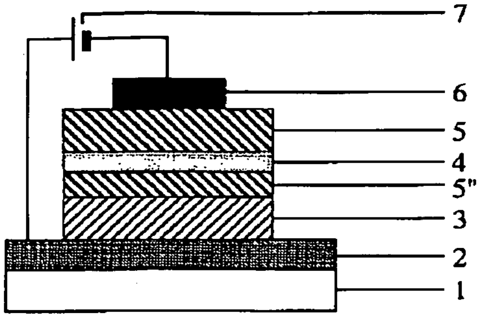
[Drawing 3]



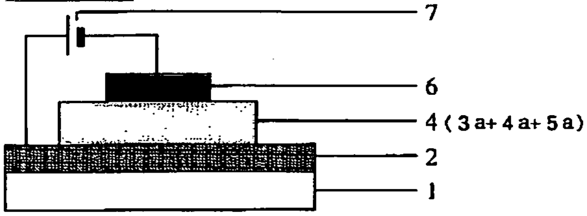
[Drawing 4]



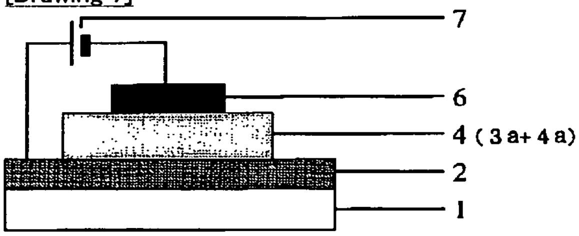
[Drawing 5]



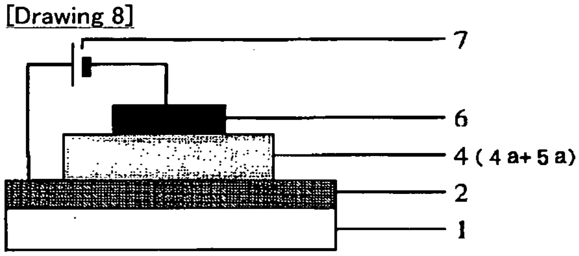
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]